

AUTOMOTIVE and Aviation INDUSTRIES

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DECEMBER 1, 1944

Vital item

"Tremendous trifles" in the operation of our mechanized war might, these fine New Departure Ball Bearings are destined for an even greater role in the peace to come.

Nothing rolls like a ball

NEW DEPARTURE
BALL BEARINGS

Heavy-duty soluble oil

solves many
 "in-between coolant
 and cutting oil" jobs

- One of the most important wartime developments in cutting fluids, made by Standard Oil, was Stanicool HD—a heavy-duty soluble oil. It filled a gap between soluble oils and cutting oils. For example:

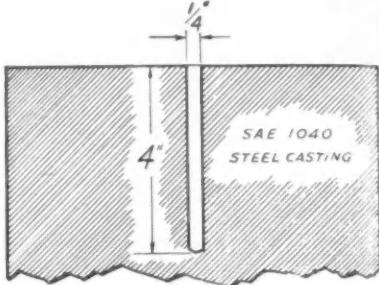
Certain metal cutting operations demand the high degree of cooling afforded by a water-and-oil emulsion but a greater degree of tool protection than is usually obtained from soluble oil. When cutting oil is used on these jobs, over-heating occurs.

Stanicool HD has eliminated these problems in many shops. Some of these jobs are briefly described at the right. A Standard Oil Lubrication Engineer can give you other examples and help you apply Stanicool HD to fill the gap between soluble oils and cutting oils in your plant.

Call the nearest Standard Oil Company (Indiana) office, or write 910 South Michigan Avenue, Chicago 80, Illinois, for a Lubrication Engineer. In Nebraska, write Standard Oil Company of Nebraska at Omaha 2.

*Gasoline Powers the Attack...
 Don't Waste a Drop!*

STANICOO
HD



Drills ground 1/3 as often.

Drilling a $\frac{1}{4}$ inch hole, 4 inches deep, in SAE 1040 Steel Castings, drills were sharpened every six pieces. Both soluble oil and cutting oil were tried. Both failed to give satisfactory results. An emulsion of 8 parts of water to 1 Stanicool HD increased tool life to 18 pieces per grind.

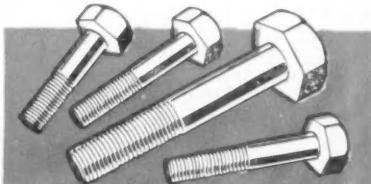
Production jumps 200% with longer tap life.

A mixture of one part Stanicool HD and ten parts water, used on a job of tapping high carbon steel, made it possible for a tap to last a full day. When using sulphurized cutting oil, taps lasted only one-half hour. More important, production jumped 200% with the use of Stanicool HD.

The greater cooling and better chip removal provided by soluble oil, plus the heavy-duty quality of Stanicool HD, will often give increased tool life and production on tapping operations where cutting oil would ordinarily be used.

Production time cut in half without impairing tool life.

A deep spading operation on a lathe making 75mm. anti-tank shells was giving good tool life and finish, but it slowed up production all along the line. When Stanicool HD replaced the conventional soluble oils that had been used, it gave equally good tool life and finish. On top of that, it reduced machining time from 51 seconds to 29 seconds per piece.

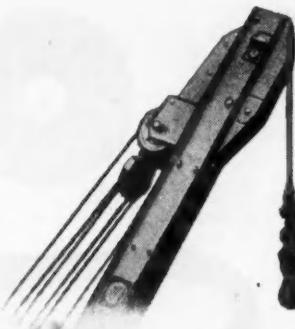


...either too hot or too slow.

A cutting oil was used on a turret lathe which was turning and threading bolts from SAE 4140 steel. High temperatures were encountered. Ordinary soluble oil cooled the tools, but too short tool life was experienced when heavy feeds and a cutting speed of 200 feet per minute were maintained. Stanicool HD mixed one part with four parts of water eliminated overheating and poor tool life, and permitted the maintenance of the high production rate.

STANDARD OIL COMPANY (INDIANA)

STANDARD SERVICE



When engineers need "guts" in the gear box they often come to COTTA. The Burro Crane, for example (pictured below), is used on some of railroading's toughest jobs. A COTTA four-speed, heavy-duty, selective type transmission provides the Burro with four distinct traveling speeds in either direction and three distinct hoisting and swinging speeds. That's typical of COTTA applications, whether in locomotives, power excavators, mine sweepers, or other heavy-duty equipment. For over 30 years COTTA has Precision-built transmission units to provide smooth, quiet, highly efficient, low-cost

transmission of power... A letter outlining your needs will receive prompt attention. Or write for free illustrated brochure today!

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COTTA HEAVY-DUTY TRANSMISSIONS

PRECISION-BUILT • SPECIALLY
ENGINEERED FOR YOUR PRODUCT

so much depends
on
the gear box

ANOTHER COTTA "ENGINEERED-TO-ORDER" TRANSMISSION FOR CULLEN-FRIESTEDT COMPANY, CHICAGO



*2½% Nickel Steel locomotive rods,
one bent cold to show ductility.*

QUENCHED AND TEMPERED
NICKEL STEEL
FORGINGS COMBINE

{ EXCEPTIONAL DUCTILITY WITH HIGH TENSILE STRENGTH }

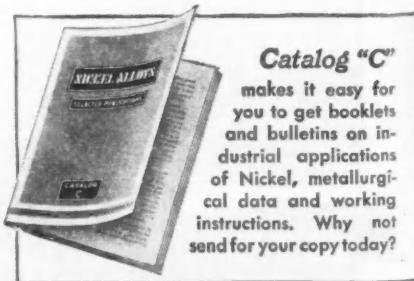
Composition and Typical Properties of Normalized Quenched and Tempered 2½% Nickel Steel Rods

| Description or Size | Melt Yield Pt. No. #s per Sq. In. | Tensile Strength #s per Sq. In. | Elong. % in 2 In. | Reduction in Area % | ANALYSIS | | | | | |
|---------------------|-----------------------------------|---------------------------------|-------------------|---------------------|----------|-------|-------|------|------|------|
| | | | | | Car. | Mang. | Phos. | Sul. | Sil. | Ni |
| Main Rod.... | 92900 | 110000 | 25.0 | 64.4 | .31 | .78 | .027 | .026 | .25 | 2.75 |
| Main Rod.... | 86500 | 104500 | 25.5 | 65.6 | .32 | .86 | .034 | .032 | .29 | 2.69 |
| Main Rod.... | 86360 | 104400 | 26.0 | 64.8 | .32 | .86 | .034 | .032 | .29 | 2.69 |
| Main Rod.... | 87850 | 102350 | 26.0 | 66.2 | .31 | .89 | .037 | .025 | .32 | 2.69 |
| Front Rod.... | 86000 | 102250 | 25.0 | 67.3 | .29 | .82 | .035 | .027 | .24 | 2.71 |
| Front Rod.... | 83900 | 104250 | 25.0 | 66.1 | .29 | .82 | .035 | .027 | .24 | 2.71 |
| Front Rod.... | 86850 | 104250 | 27.0 | 66.1 | .32 | .86 | .035 | .025 | .30 | 2.65 |
| Front Rod.... | 89500 | 107050 | 25.5 | 65.6 | .32 | .86 | .035 | .025 | .30 | 2.65 |
| Back Rod.... | 89500 | 107650 | 25.0 | 62.7 | .30 | .79 | .030 | .025 | .22 | 2.71 |
| Back Rod.... | 87500 | 106450 | 25.0 | 65.4 | .29 | .82 | .035 | .027 | .24 | 2.71 |
| Back Rod.... | 87000 | 105600 | 25.0 | 65.4 | .29 | .82 | .035 | .027 | .24 | 2.71 |
| Back Rod.... | 88150 | 104850 | 26.0 | 66.8 | .29 | .82 | .035 | .027 | .24 | 2.71 |

Specimens Taken from Mid-Section of Prolongations of the Forgings

The above table compiled by the American Locomotive Company shows the chemical compositions and mechanical properties of some normalized, quenched and tempered nickel steel front, main and back rods recently produced as replacement rods for locomotives being speeded up and rebalanced. These values are typical of replacement rod forgings recently tested by that company.

Quenched and tempered nickel steel forgings provide high tensile strength and ductility, combined with unusual toughness and high fatigue strength—qualities which tend to obviate breakage and assure long, trouble-free service when employed in heavy duty machinery and equipment.



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Volume 91

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THIS factory on wheels is one of the recently developed rock crushing and screening plants which are now being used effectively by the U. S. Army in the South Pacific. Due to their maneuverability and complete portability, these rubber-tired rock crunchers are helping to crush Jap empire hopes.

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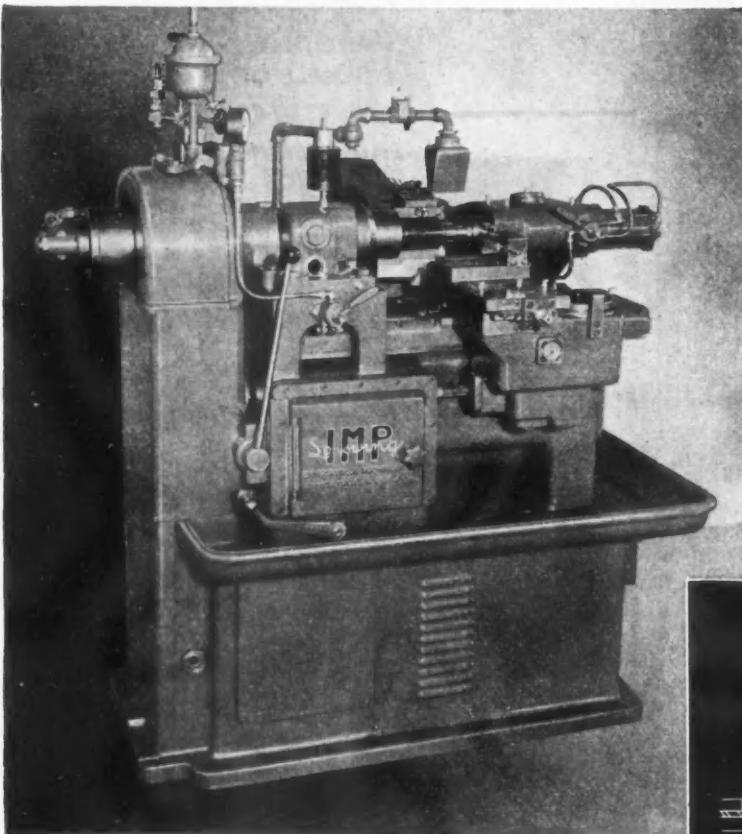
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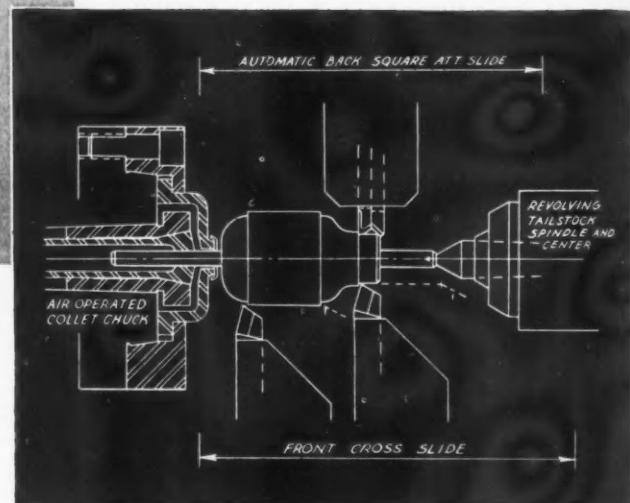
PROBLEM: To automatically turn, chamfer and face electric motor rotor and starter commutators, maintaining a fine finish and extremely close tolerances.

SOLUTION: The Lo-swing IMP Lathe with special equipment was selected for this job primarily because of inherent design features which permit high spindle speeds and unusual turning accuracy.

The work is held and driven from one of the ball-bearing seats of the shaft with an air-operated collet chuck. The tailstock end is supported on a revolving center, the movement of which is actuated by an air cylinder. This method of holding and driving the rotor assures the close concentricity which is re-

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*Automatically MACHINED
TO HIGH ACCURACY
AND FINISH ON*
Lo-swing IMP



quired between the bearing seats and the O. D. of the commutator. The operation consists of turning the O. D. of the commutator and rotor, the facing of the shoulder (which is part of the commutator) and the chamfering of the shoulder.

Several other Lo-swing set-ups have been developed for this type of work. We suggest you send in your prints for our estimate.

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THE aluminum crankcases being machined here are for 2200-hp, 18-cylinder aircraft engines . . . giant power plants that help B-29 Superfortresses carry heavier bomb loads faster and farther than any bombers ever built.

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Soluble Oils. Texaco Cutting Oils lubricate the tools, carry away heat and prevent chip welding, thus lengthening tool life, assuring greater output.

The services of a Texaco Engineer specializing in cutting coolants are available to you through more than 2300 Texaco distributing points in the 48 States.

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TUNE IN THE TEXACO STAR THEATRE WITH JAMES MELTON SUNDAY NIGHTS ★ METROPOLITAN OPERA BROADCASTS SATURDAY AFTERNOONS



Fox Hole Fog Generator

No larger than a soldier's foot locker, the M-2 bantam smoke generator can make fog from a foxhole. Its mobility brings large-area smoke screens to beachheads, mountain passes and jungle trails for the first time in history.

Smoke-screen protection for front line and amphibious operations, where space is at a premium, is provided for the first time by the new, highly mobile M-2 mechanical smoke generator. Weighing only 180 pounds, this midget can blot out, under favorable wind conditions, an area five miles long and 200 yards wide.

The Lauson single cylinder air-cooled gasoline engine powering the unit is specially designed for military use. Operating efficiency of the engine is safeguarded against extreme conditions of dust and other atmospheric impurities by a United Oil Bath Air Cleaner. Thousands of similar engines are in use by the Air Forces, Chemical Warfare Service and Navy on a variety of applications.

* Many new uses in industry and agriculture for small power units like this will result from their ingenious applications to military purposes. And the same standards of performance which have distinguished United products used on war equipment and on cars and trucks, on tractors and farm machinery for over 19 years, will be ready for high-production needs tomorrow.

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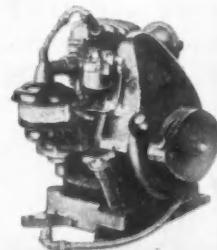
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★ IGNITION SWITCHES ★ ROLLED SHAPES ★ DOVETAILS

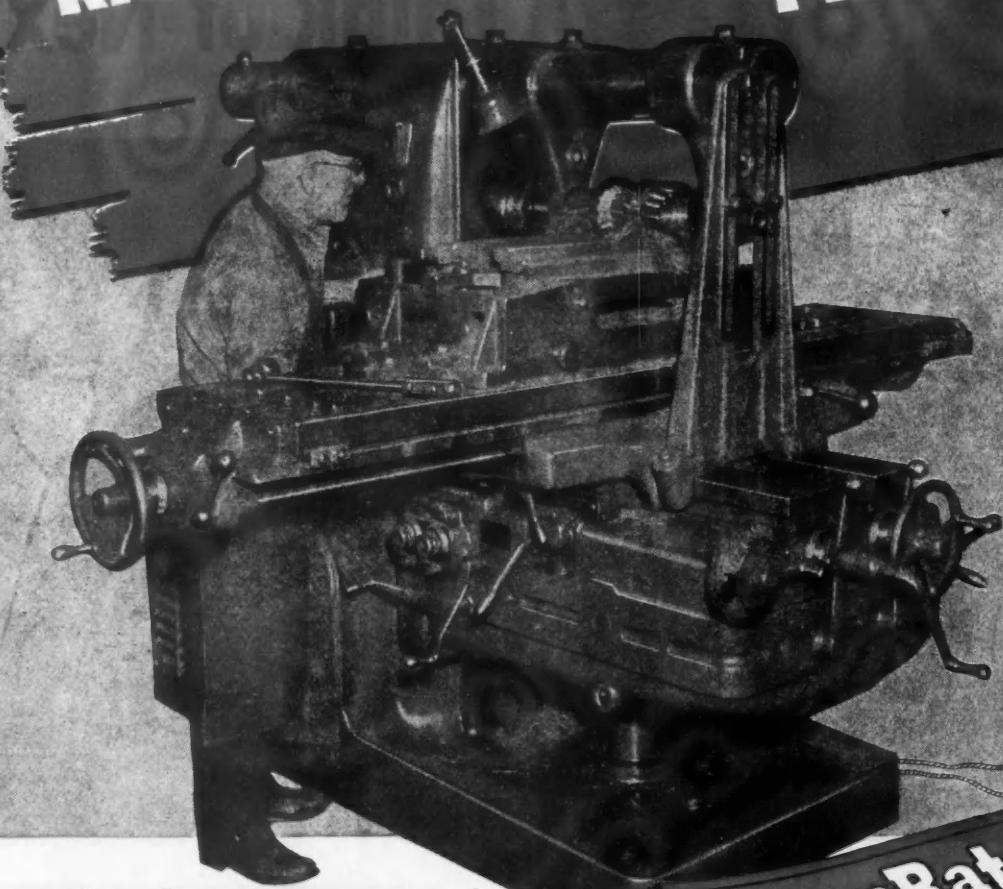


A Lauson RS special one cylinder gasoline engine made of aluminum operates the unit, consisting of boiler, blower and gear pump; it makes smoke in 40 seconds from a cold start.

Dust protection is afforded by the United Oil Bath Air Cleaner Model H30-12480 shown above.



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Range in a milling machine — the capacity to handle a wide variation of operations at the most efficient feeds and speeds—is always an important factor.

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GINEERED TO DO THE JOB**

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- Special Machines—Consult K & T engineers.



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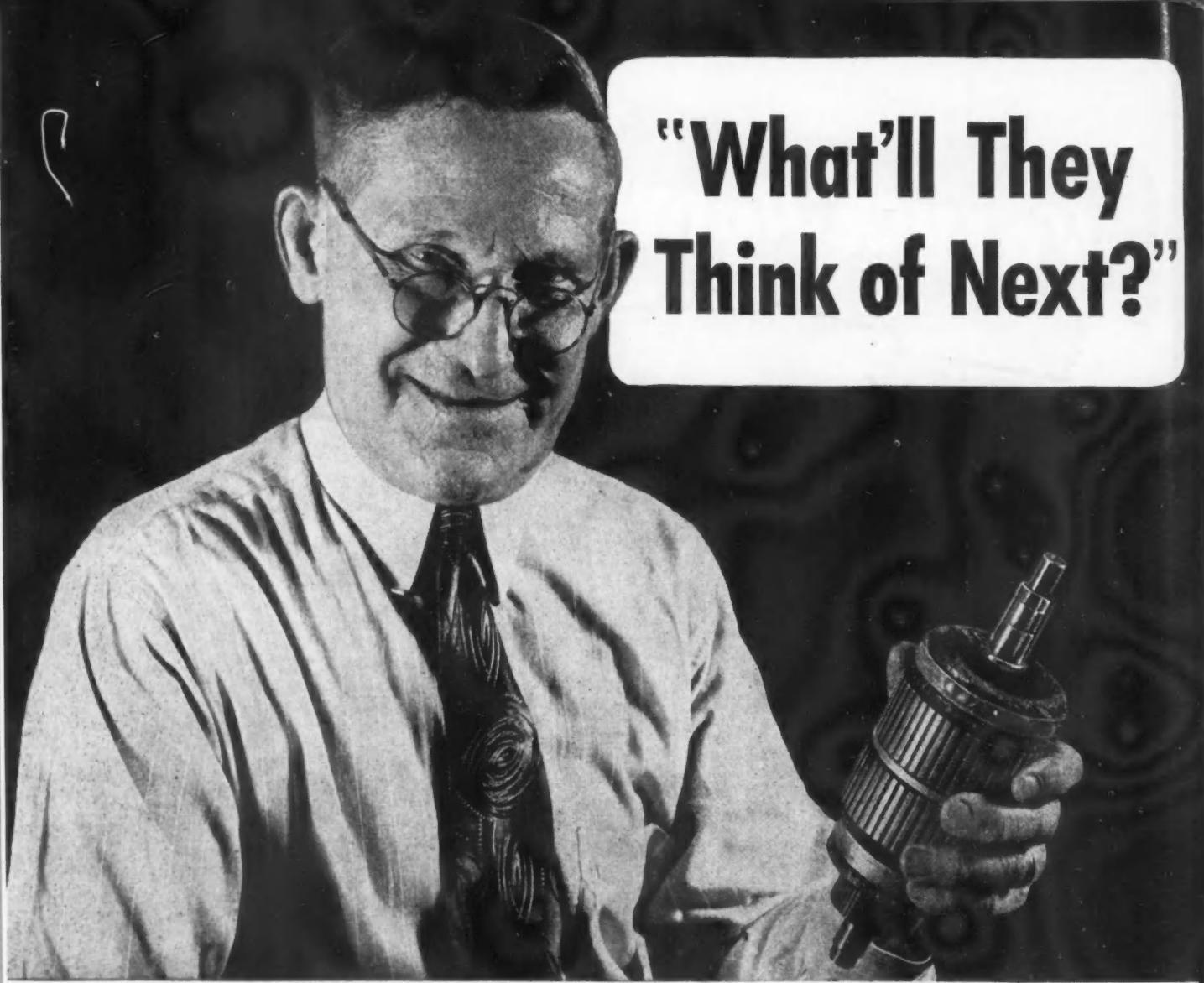
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Milwaukee Machine Tools

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TRIES

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AMAZING how they do things these days! Only one thousandth of an ounce out of balance . . . yet they caught it in a flash. In just a few seconds, the unbalanced forces in this armature were located and measured . . . and corrections clearly indicated by a DYNETRIC BALANCING MACHINE*. That's modern electronics for you!

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Both manufacturers and power companies have long torn their hair over the problem of spot welding heavy gauges. Conventional AC single phase welders cause serious disturbance to the usual three-phase power supply, operate at low power factor because of the heavy reactive load, and demand high power due to the high secondary resistance.

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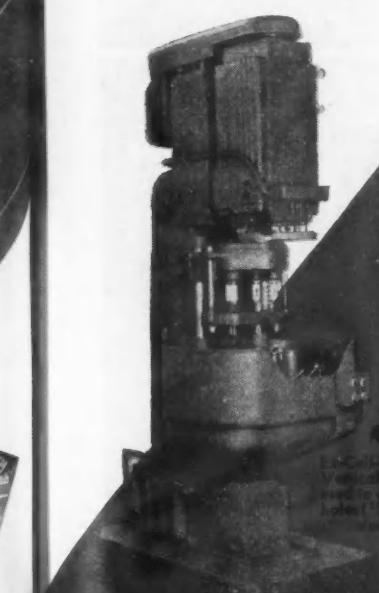
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used to drill and machine
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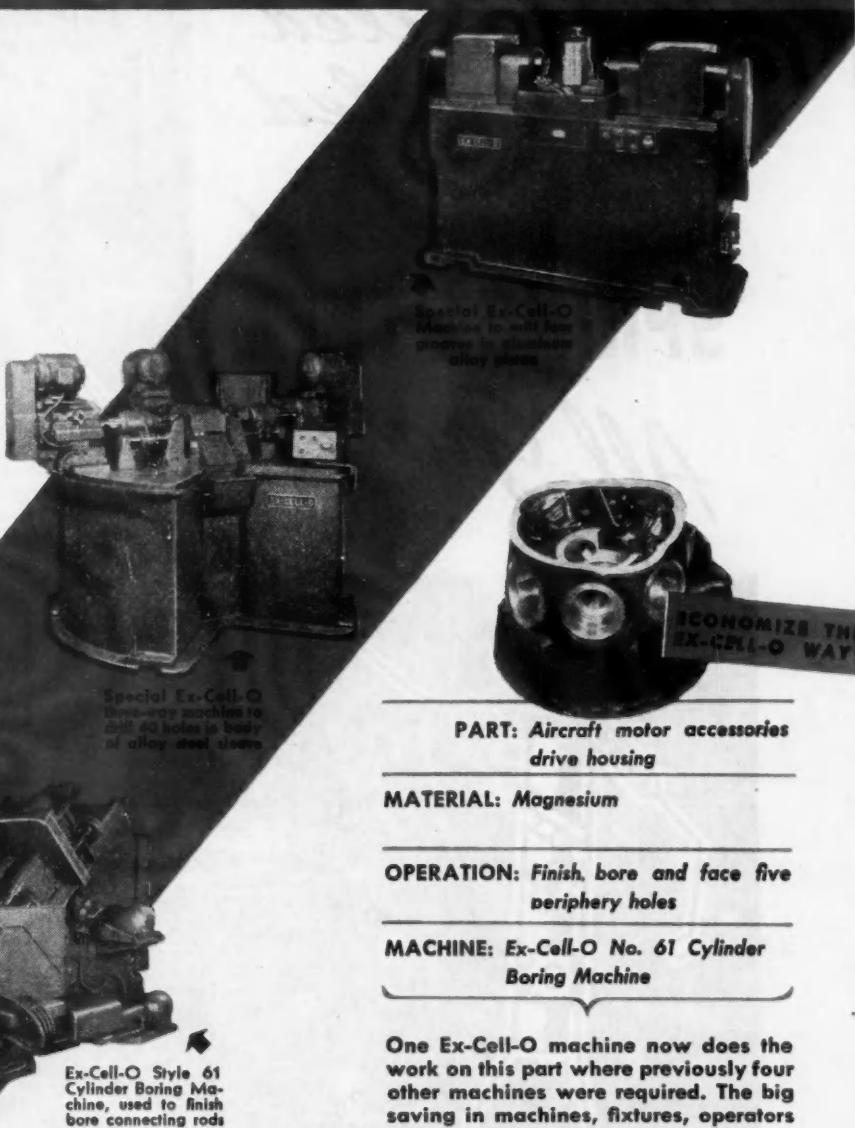
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TOOLS

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production, high
accuracy, and
greater economy
through multiple
operations are
required . . . con-
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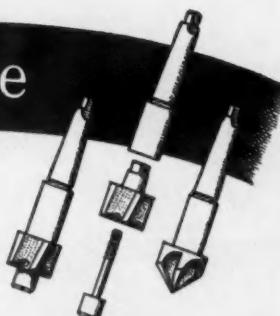
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AUTOMOTIVE and AVIATION INDUSTRIES

Volume 91 December 1, 1944 Number 11

Rehabilitating War Veterans 17

There is a lot of work being done in the automotive field to meet the challenge that battlefields have sent back with the returning soldiers. The accomplishments in this direction are remarkable. Here is an outline of what is being done and what is to come.

Tube Turns Extends Forging Service 20

This company, drawing on its 18 years of experience, has been doing some unusual things in the war effort. It shows versatility as well as real accomplishments.

Short Cuts 24

On page 24 you find another lot of the Short Cuts that have been proving so popular and profitable.

Mirror-Image Template Reproductions 26

It has often been said that there is nothing new under the sun. If you believe it do not read this article for it gives the lie to the old idea.

Triptane, A Super Fuel 34

This article on fuel is not only up to the minute in timeliness but looks ahead into the future. To be well informed you must read it.

Airframe of the Hawker Typhoon 41

Here is some data on this much discussed warplane complete with text and illustrations that show the constructional details.

The Importance of Pre-Reconversion Planning Now

by Julian Chase

EMPHASIZING the distinction that should clearly be drawn between pre-reconversion planning and actual reconversion, the Automotive Council for War Production has prepared another presentation to show how adequate preliminary planning now for reconversion to be effected later, at whatever may be the proper time, would materially reduce both the extent and the duration of reconversion unemployment.

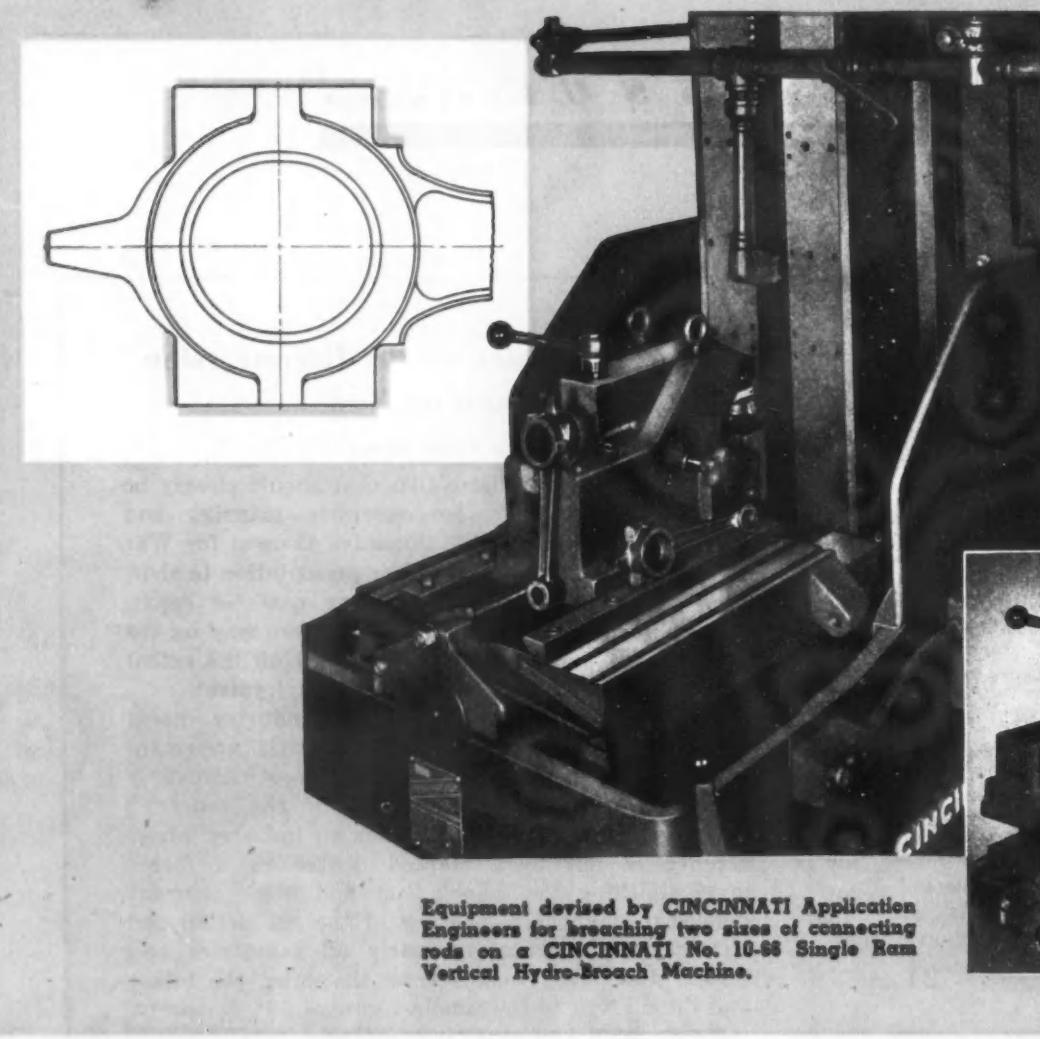
It is natural that the automotive industry should take leadership in the advocacy of early pre-reconversion planning. It is not only the most thoroughly converted industry but also one of the country's largest employment groups. It is an industry whose activity is felt to a marked degree as a factor in establishing the employment and wage payment indices throughout a long list of the production and distribution branches of nearly all industries and trade. Its gamut ranges from the mine, the forest and the oil well to the smallest garage. It is, too, an industry for whose peacetime products there is such a huge pent-up demand that V-Day or VE-Day, whichever it is to be, will loose a flood of money to go back into the pay envelopes of millions of wage earners.

Pre-reconversion planning now, the Council asserts with experienced conviction, will actually help and in no way hinder the war production effort. It points out that it is already difficult to keep workers on war production jobs because of what some national leaders call "peace jitters." It holds that there would be a greatly modified inclination on the part of war workers to switch from war to peacetime jobs if they knew that adequate preparatory steps were being taken now to expedite reconversion and thus improve their chances for quick re-employment after Go-Day.

Before the automotive plants can take back great numbers of workers for civilian production, essential preparatory work must be done by skilled specialists. The help of machine tool and tool-and-die shops is needed. Materials and parts supply lines must be prepared. These are things that are understood by those in all parts of the industry, but they are not so clearly seen by others. For that reason, there is an important job of education to be done and it would be well, from all points of view, if everyone in or allied with the automotive industry recognized that that job is partly his and participated in it.

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Equipment devised by CINCINNATI Application Engineers for broaching two sizes of connecting rods on a CINCINNATI No. 10-66 Single Ram Vertical Hydro-Broach Machine.

One Stroke of the Ram BROACHES ALL THESE SURFACES

Here's a familiar part—a forged steel connecting rod—that may have a counterpart in your post-war product. And if it does, you want to be sure that the latest methods are employed in the machining operations. These examples show what can be accomplished.

There are two sizes of rods, the smaller requiring seven machined surfaces (see sketch), and five for the larger. After deciding upon broaching as the most economical method of machining, and then choosing a CINCINNATI No. 10-66 Single Ram Vertical Hydro-Broach as the machine having the required metal removal and productive capacity, CINCINNATI Application Engineers worked out the two sets of fixtures and tooling illustrated here. In both set-ups, all the surfaces are broached in one downward stroke of the ram. Production of both sizes averages 106 parts per hour... much faster than the previous method.

Perhaps many similar components of your present and proposed products could be machined more economically on CINCINNATI Hydro-Broach Machines. Our Application Engineers will be glad to analyze your requirements. Write for full information, enclosing prints of your parts.



CINCINNATI No. 10-66 Single Ram Vertical Hydro-Broach Machine. Complete specifications may be obtained by writing for catalog No. M-886.

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Published on the 1st
and 15th of the month

December 1, 1944
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How Car Manufacturers are Rehabilitating War Veterans

By Leonard Westrate

THE automobile industry is meeting squarely the challenge imposed by the steadily increasing flow of veterans of World War II returning from the battlefield, many of them with service connected disabilities. Without exception, the various car manufacturers have instituted programs of one kind or another to place these men in jobs where they can perform work for which they are best suited and where they can rehabilitate themselves as useful citizens. Many of the companies are reluctant to say very much about their activities in this respect because they do not feel that they are doing anything more than fulfilling an honest human obligation to the men who have given so much to help beat down international gangsterism.

Details of the various programs vary between com-

panies, but all of them have the same common objective—to provide the opportunity for the veteran to stand on his own feet and take his place in the civilian world. One of the first companies to undertake a comprehensive rehabilitation program is the Hudson Motor

Car Co. Started more than two years ago, the program has been so successful that the U. S. Veterans Bureau has ranked it one of the top three in the Detroit area. Already more than 1000 veterans of the present war, 155 of them battle casualties, have been



Training of World War II veterans is being rounded out by providing instruction in drafting, blue print reading and other industrial subjects to supplement their actual shop or office work. Rehabilitation of them on a substantial basis is the aim of the automobile companies.



hired and are working at jobs they can best do in view of their physical condition, training, and education. Only 325 of this group are former Hudson employes. The others either worked elsewhere or never had regular jobs before entering the service.

Like many other companies, Hudson has set up a special staff to handle its veteran placement program. It is headed by Major Otto Rowoldt, a veteran of both World Wars, who himself was disabled in 1918. He has had considerable experience in presenting claims to the Veterans Bureau. Assisting him are George P. Alberts, and Martin Brehem, who has served with the War College in Washington.

Hudson makes it a practice to place veterans in jobs where they can compete successfully with other workers. Knowing that they can perform their jobs ably, they are much more likely to make a go of it than they would if placed in jobs beyond their ability. Some of the veterans require special training in Hudson schools after they have been found physically capable of certain jobs. They are paid while learning. When one veteran, who had received a gun wound, was found disabled for active work, he was trained by Hudson to work in the time study department. Another who had suffered a bayonet wound, which disabled him for his former job as a truck driver, was trained to do light sheet metal work. A veteran who had been discharged with severe burns and shock was so unnerved by the clatter of his riveting job that he was transferred and trained as an apprentice electrician.

General Motors Corp. laid the groundwork for its rehabilitation program in November, 1943. With upward of 106,000 employes in the service, the corporation had laid down a general overall policy, but leaves specific details to the various divisions. The policy holds that to be successful, placement of handicapped persons must be on a sound basis from the standpoint of productivity and economic return to the worker, and any attempt to make work will prove unsatisfactory to both the individual and the corporation. This does not preclude technological re-arrangement of a job or a reasonable break-in period, since a handicapped person successfully placed is no longer handicapped from the standpoint of earnings or productivity. If the veteran is disabled in such a way that he cannot perform the job he had before going into service, he is given liberal on-the-job training on an operation which approximates as closely as possible the one he held formerly in respect to classification and pay.

At the General Motors Institute of Technology at Flint, Mich., a two-semester course for the specialized training and rehabilitation of veterans has been in-



Two honorably discharged servicemen receiving instruction at a training school at one of the automobile plants. In the center is the mother of two small children who decided to learn how to make planes to help speed the return of her husband who is in the Air Corps.

augurated. The men alternate between classroom and practical work in the plants or divisions at four- or eight-week intervals. The courses are planned to take into consideration that the education and training processes of the veteran may have been interrupted by his entry into service.

General Motors now is employing approximately 18,000 returned veterans. About 9000 of them are former GM employes, of whom 50 per cent have impairments of some form. However, 80 per cent are able to take over their former jobs, while 16 per cent need minor rehabilitation. Around four per cent present a difficult placement problem and a small fraction of one per cent do not fit in at all and are referred to the Veterans Administration. Experience with returned veterans at GM shows that they are eminently satisfactory and above the average wartime worker in performance.

Under the GM re-employment program, the veteran first is given a thorough physical examination, after which he is placed in one of five categories. Those placed in Group 1 provide no particular difficulties, since they have no physical disabilities and may be placed in any job in the plant.

Those who are still affected by some physical or mental condition which makes them unsuited to certain types of work, but who can perform some jobs efficiently, are placed in Group 2. This group is classified according to individual limitations. One method of classification in use is as follows: 1. No hazardous machinery. 2. No heavy lifting. 3. Ground-level work only. 4. Avoid dust, fumes, and skin irritants. 5. No extensive walking or standing. 6. Restrict to noise-free areas.

Group 3 includes those individuals who have a severe handicap which requires individual special attention for safe placement. This group presents the greatest problem, requiring careful matching of the man's ability to the job and calling for close follow-up to insure that the handicapped employe becomes adjusted and is able to carry the work after a reasonable break-in time.

Those temporarily unable to work are placed in Group 4. This group includes cases with contagious diseases, unhealed tuberculosis and other conditions from which the individual may recover without permanent disability. Men in this category are referred to the nearest field office of the Veterans Administration which is charged with providing medical care, handling applications for pensions, and providing vocational rehabilitation for disabled service men.

Those men who can not be fitted to any necessary
(Turn to page 67, please)

Early Pre-Reconversion Planning —Less Unemployment

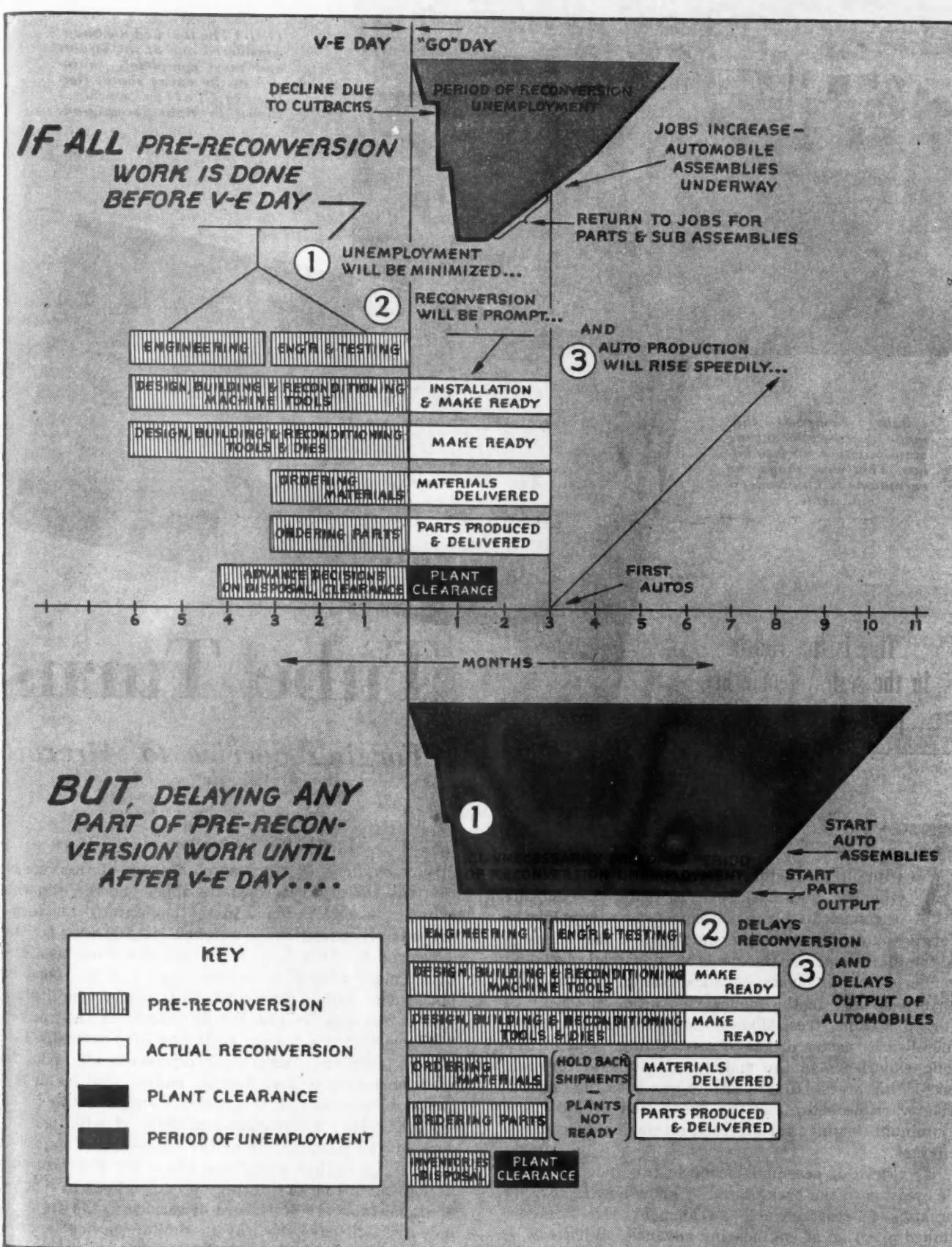
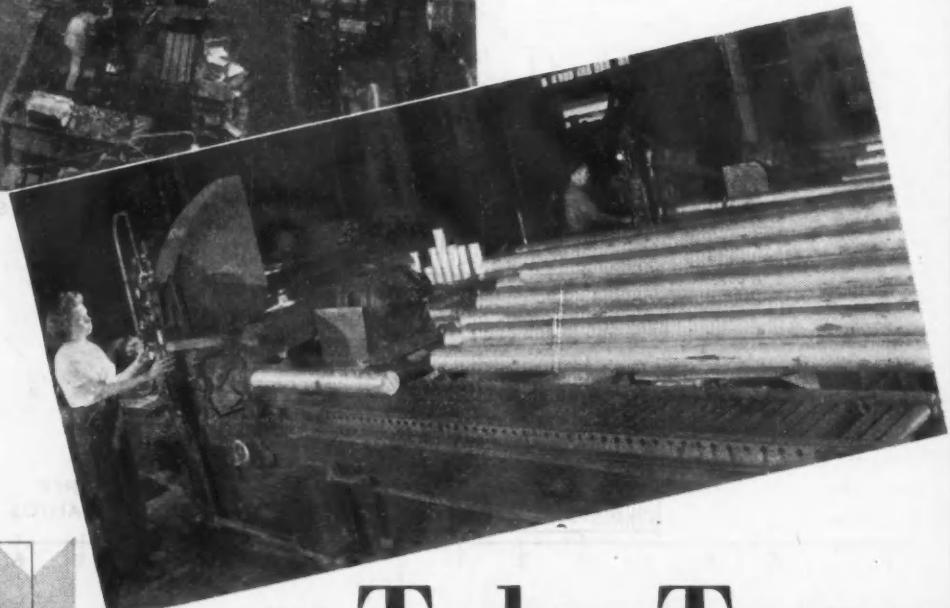


Chart prepared by Automotive Council for War Production



(Left) The tool and die Shop, considered one of the largest and most completely equipped in the entire south. Battery of Keller machines shown in right foreground.



(Right) Campbell Cut-matic saw used in cutting aluminum bar stock to billets. This view shows the exceptionally long conveyor or table.

This is the 100th
in the series of monthly
production features

Tube Turns

Forging Service to Aircraft

ALTHOUGH the history of Tube Turns, Inc., Louisville, Ky., goes back some 18 years, the company is comparatively a newcomer as a supplier of forgings to the automotive industry. Tube Turns is a familiar name in the general industrial field—oil refineries, power plants, chemical plants, and the merchant marine—as the pioneer in the development of forged fittings, tees, elbows, etc., for piping systems installed by means of gas or arc welding. Out of this long experience in the making of intricate forgings on forging presses and upsetters was born the remarkable wartime setup for the production of steel and aluminum forgings for aircraft, marine, and Ordnance engines.

Its record of accomplishment in this new field may be credited to the background of know-how in forging practice, in research and development, and in a continued program of engineering advance. What can be achieved in this direction may be illustrated by a single case taken from current experience. Consider a steel cylinder barrel forging for a 12-cylinder V-type

marine engine. Distinguishing feature of this one is that the barrel is closed at its upper end to form the cylinder head. As made in the beginning, this forging was practically solid, weighed 190-200 pounds. As developed by Tube Turns, the sections have been reduced more closely to finished size and the bore is punched to within close approximation of rough size. The barrel now weighs but 83 pounds in the rough. This represents a weight reduction of practically 115 pounds per piece. Actually, it represents 1380 pounds of chrome-molybdenum steel per engine, that no longer has to be removed in the machine shops in the form of chips. It is a remarkable example of what can be done by the coordination of the know-how of experts.

Tube Turns has ambitious plans for the postwar period in its role of forging specialist both in aluminum and in steel. Its record of service to the aircraft industry will pave the way to similar service in producing the gamut of peacetime products required by motor vehicles, aircraft, and replacement parts.

Facilities consist of two separate plants: the steel

By Joseph Geschelin

forge housed in an expansion of the original fittings plant; and the aluminum forge which is an entirely new enterprise.

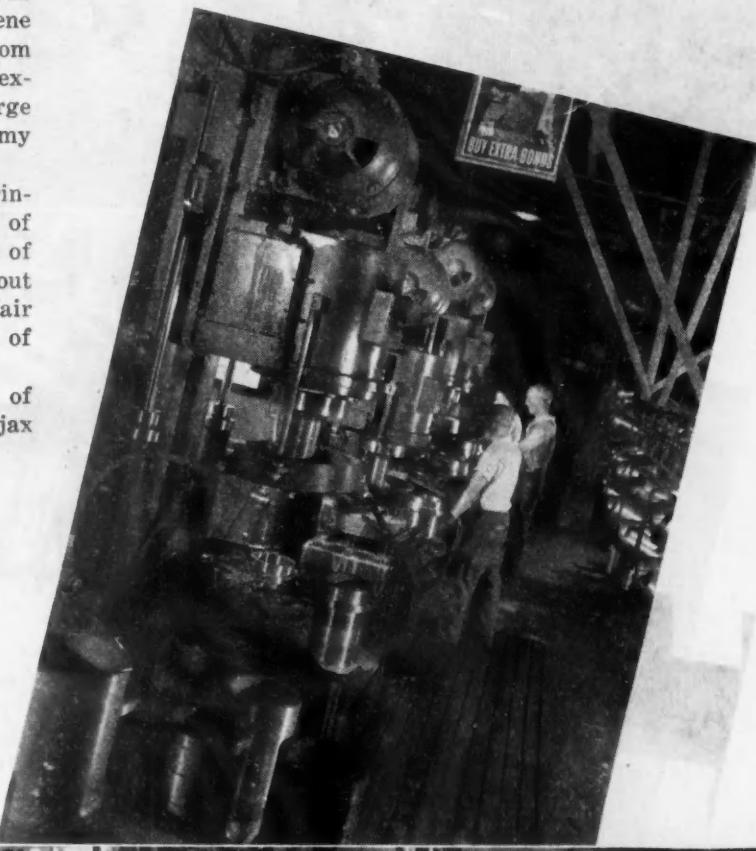
The aluminum forge is housed in a strange environment for a forging plant but symbolic of the enterprise of American industry during the War. Time was short and no suitable industrial buildings were available. So Tube Turns took over the State Fair Grounds in Louisville. Thus the visitor will find the aluminum forge established in the spacious bright yellow-hued buildings formerly the scene of horse shows, cattle shows, and the circus. From the viewpoint of this observer they make an excellent work-place, situated as they are in a large park, and providing light and airy and roomy surroundings.

Let us look first at the steel forge. Its principal activity during the War is the production of cylinder barrels for numerous makes and types of engines, mostly radial aircooled engines. About ten different types are made, representing a fair cross-section of the principal manufacturers of radial engines.

Fabricating equipment consists primarily of 6-in. and 9-in. National upsetters and 8-in. Ajax

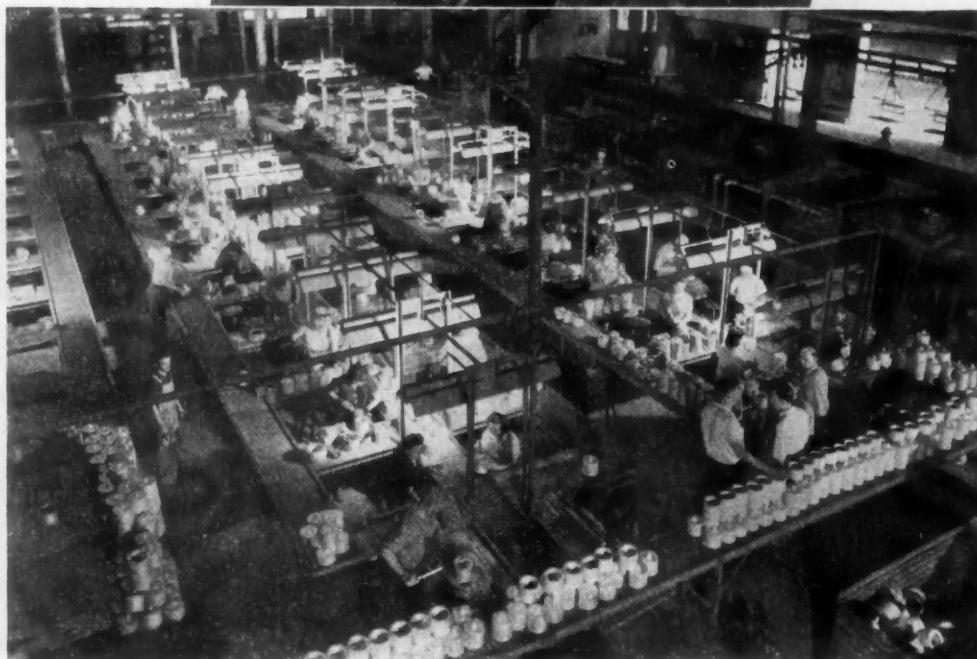
upsetters. Forge shop equipment also includes heating, annealing and normalizing furnaces, quenching tanks, a large battery of American and Pangborn shot blasting machines, and a battery of the familiar Andrew C. Campbell Cutmatic abrasive cut-off saws.

Serving the forge is a spacious machine shop employed for the rough machining of the cylinder barrels, designed to relieve the customer of the task of

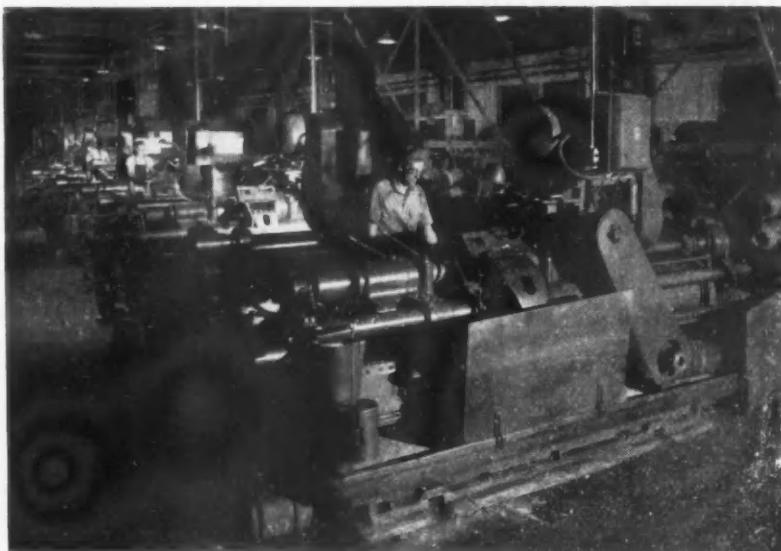


Extends and Automotive Fields

(Top) Cylinder barrel finishing department: four Baker boring drills on one side of the conveyor line. There are four drills in the same arrangement on the other side of the line.

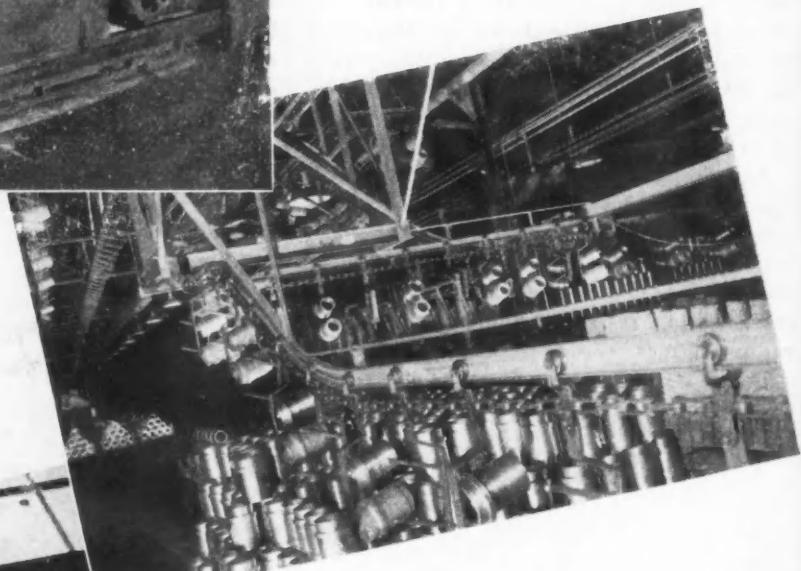


(Right) Aluminum piston finishing department showing polishing and burring benches. A complete system of Mathews gravity roller conveyors is found here.



(Left) Cylinder barrel turning department showing a battery of Lo-Swing and Fay automatic lathes.

(Below) Starting point of the closed circuit monorail conveyor system carrying cylinder barrels through the heat treating and finishing departments.



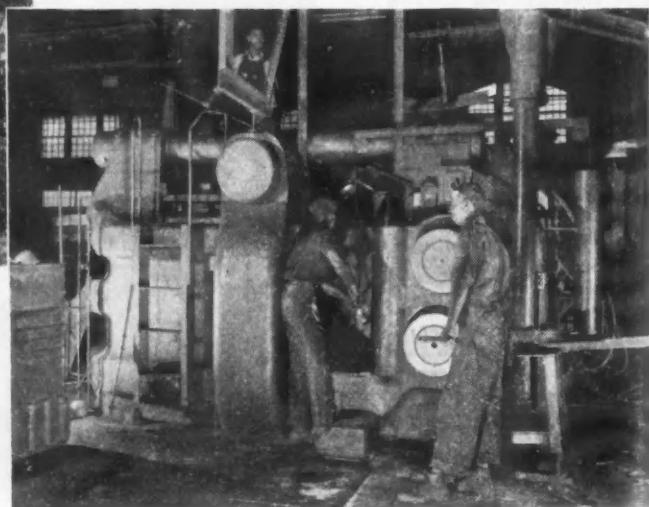
(Below) View showing unusual monorail basket conveyor line carrying forged pistons from Horse Show building to Merchants and Manufacturers building for heat treatment and finishing.



(Right) Close-up view of 9 in. National upset forging machine in full production on aluminum pistons.

handling roughing operations with their incidental scrap. Machine lines are equipped with batteries of 24-inch Fay automatics and six of the Model R-14 Lo-Swing automatic lathes and a battery of the heavy-duty single spindle Baker drills for rough boring of barrels.

Material for barrel forgings is received in the form of long bars, which are cut off to billet size on the Campbell Cutmatics. Upsetting is done in one heating and completed in the four sta-



tions of a given machine. Billets are heated in furnaces to forging temperature around 2150 F before upsetting. From the upsetter, the work is moved to the rear of the upsetter lines on a flight conveyor, then suspended on a heavy-duty, power-driven roller conveyor for cooling while in transit to the annealing furnaces. Following annealing the barrels are shot-blasted and are ready for machining.

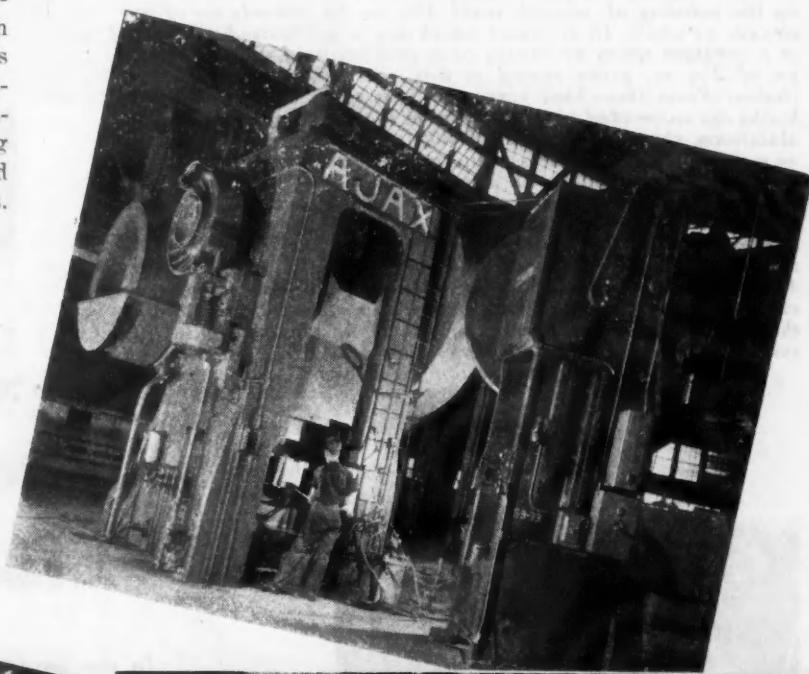
To this end, the barrels are mounted on the monorail which traverses the machine lines. Here the operators pick off the parts for which their machines are tooled, maintaining a continuous stream of production activity. All of the automatic lathes are fitted with high-speed steel and cemented carbide tools.

After machining, the barrels again are suspended on the monorail and are transported to the heat-treating department for normalizing, quenching, and drawing. This is followed by final inspection and 100 per cent Brinell testing.

It is natural to find a comprehensive system of metallurgical control beginning with the sampling of incoming raw materials and control of specifications for all heat-treating operations. In addition, the laboratory is concerned with trouble-shooting both in the plant and on the outside; and with fundamental research in all its phases.

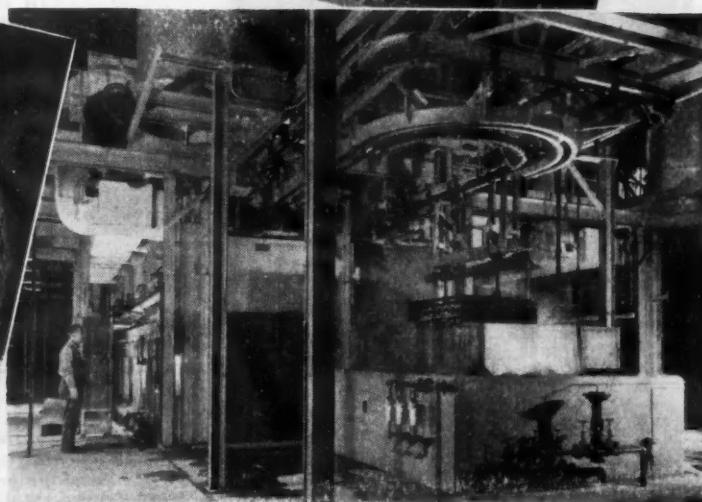
The metallurgical laboratory is provided with complete facilities for both physical and chemical analyses, including the machining and preparation of test specimens. Experimental and control-heating can be done in small furnaces. All the standard physical tests can be made as well as several special tests found by experience to give a measure of the suitability of raw materials and finished products for their intended purpose. The latest design of metallographic equipment is used to study the quality of both experimental and regular production work. All temperature control equipment is calibrated and controlled by comparison with basic standards. A carefully planned program of checking random samples from the end of the production line provides a guarantee of good quality in the products shipped.

(Turn to page 80, please)

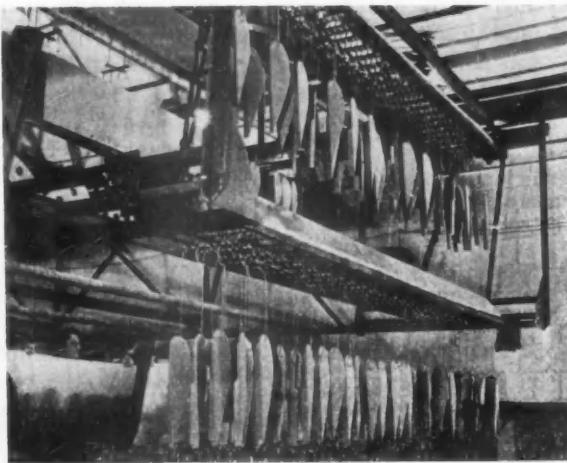


(Right) The huge 2500-ton Ajax press in full production on aluminum fuel pump housings.

(Below) 2000-ton H.P.M. press in production on airplane cylinder barrel muffs.

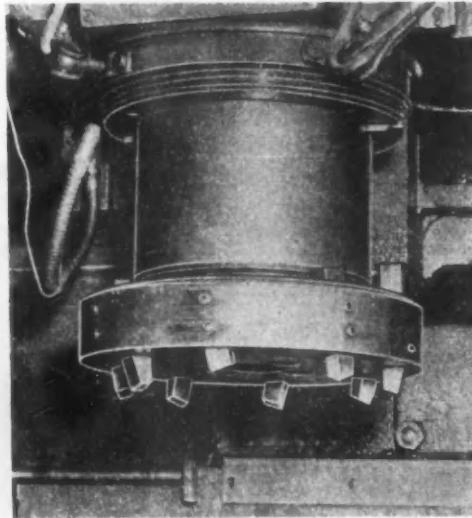
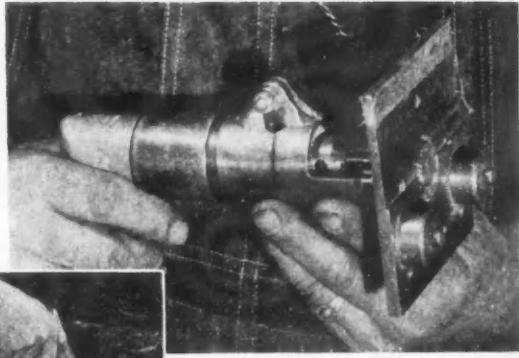


View of J. D. Ross Engineering Corp. furnace showing loaded basket just removed from furnace and being dipped into quench.



Designed by the Plant Engineering Dept. at the Akron plant of Goodyear Aircraft Corp., this unique conveyor system has speeded up the painting of aircraft parts. The carrier is made up of two strands of chain 15 ft. apart which are synchronized and kept at a constant speed by means of a jack shaft. Load bars made up of 2½ in. pipes spaced at 6-ft. intervals connect the two chains. From these load bars numerous types of spreaders and hooks are suspended to get maximum loading. Several full sized aluminum sheets or as many as 300 small parts may be carried on a single load bar. It was found that a conveyor speed of 24 in. per min., using a paint with a specific gravity of 1.03 is the most suitable. As the conveyor moves forward it drops vertically into the tank located in a pit, the top of which is at floor level. After leaving the tank the return travel is directly above and opposite the newly loaded line moving toward the tank. The dip tank, 40 in. by 16 ft., has a working depth of 56 in. Agitation is created by the use of two 9-in. screws located in troughs running the full width of the bottom of the tank. An automatic CO₂ system is installed within the enclosure over the dip tank, over which are automatic doors.

Short

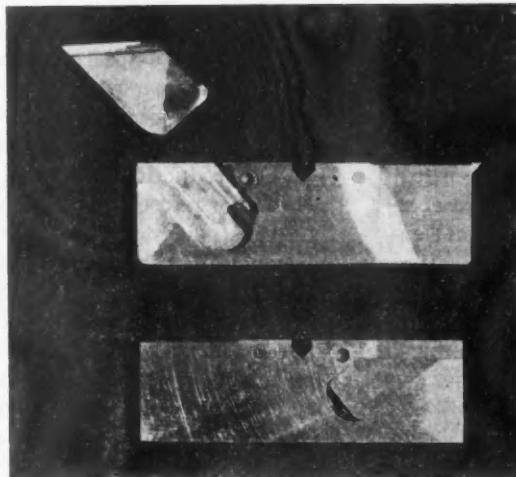


Milling time has been reduced 40 per cent, cutter life increased, and regrinding and sharpening of tools considerably speeded up by the development of a new milling cutter at the Philadelphia Maintenance and Repair Dept. of Westinghouse. A total of eight sintered carbide tools are mounted in an adapter to make a staggered tooth vertical milling cutter. The tools are mounted so that each tooth is set 3/32 in. closer to the center than the preceding one. The tools are also mounted

In the construction of wing assemblies at the Ryan Aeronautical Co., when the final section of the metal skin is put down there is an overlap on the leading edge spar that must be trimmed back to allow for room on the spar to attach the leading edge section. By mounting a motor driven, rotary, vixen file in a vertical position and attaching the tool to a guide table, which uses the edge of the spar as a guide, then the file can be adjusted to cut any distance back from the spar edge that is desired. The resultant trim is uniform and clean. The operation saves manhours which were formerly devoted to hand filing, measuring and shearing.

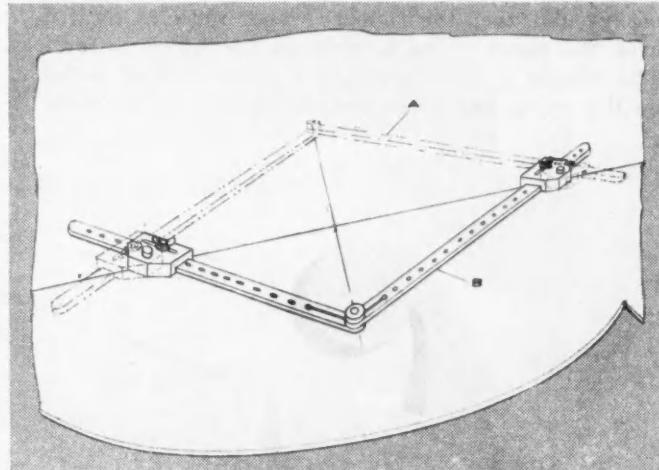
in such a manner that each tooth projects out 1/16 in. more than the preceding one. Slots in the adapter have a 10 deg. angle that give a negative rake to the tool. The cutter can take up to a one-inch cut. Used chiefly for roughing and semi-finishing work, the usual depth of cut is ½ in. One setup was made to take an intermittent cut ¾ in. deep on cast steel at 80 rpm and with a one in. feed per min.

Cuts



A new adjustable facing cutter, used in boring bars on horizontal boring mills, has been devised at General Electric's Pittsfield Works. The cutter consists of two blades inserted in diagonal grooves machined in either end of a holder and made adjustable by means of set screws threaded through the holder into the grooves. The blades are locked in position by pressure which is applied from off-center circular clamps built in the holder. When a blade becomes dull it can be removed from the holder, sharpened, reset in the groove, and a slight adjustment with the set screw brings it back to its previous correct dimension in relation to the other cutting blades on the boring bar.

Designed to facilitate sheet metal layout work where it is impossible, due to irregular contours to use the sides of the sheet as a working edge, this production tool developed at The Glenn L. Martin Co. makes it possible to readily locate points and erect vertical and horizontal lines in reference to a base line scribed on the surface of the work. It consists of two bars with accurately spaced tapped holes along their length which pivot around a bushing. On each bar is a block with a groove into which the bar is recessed and a hole to accommodate a dowel pin with a slip fit. The blocks are secured to the bars by thumb screws passing through a slot in the block and engaging the tapped holes. To lay out a line with the new device, a base or reference line is scribed on the work, holes are drilled along this line at widely spaced points, and dowel pins fitted therein with a pressed fit. The blocks of the layout tool are then placed over the dowel pins and position A located by placing the thumb screws along the slots in the blocks, after which the screws are tightened. Position A is then marked with a scribe or drill through the pivot bushing at the joint of the bars. Next one bar is removed from the dowel pin and the bars hinged in the opposite direction. This locates position B, which when connected to A gives a line perpendicular to the base or reference line. To erect other perpendicular lines spaced accurately from the first line, it is merely necessary to loosen the thumb screws and make adjustments either by sliding the screws in the slots or moving them to new holes. By drilling two holes along any vertical line and inserting dowel pins, the tool may be used to draw other lines parallel to the base line.



Engineers at the Formica Insulation Co. discovered that Formica cured sheet could be heated to a temperature just under the blistering point, and if stamped quickly, could be formed to shape for bomber parts. The press used in the technique has inexpensive dies made of wood. In the photo are shown cut blanks, the press, and finished parts.

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Mirror-Image Template

A NEW method of utilizing the off-set litho process of template reproduction has been developed by manufacturing research engineers of Consolidated Vultee Aircraft Corp. that enables template makers to produce "mirror-image" patterns from loft lay-outs. Although the method can not be called fool-proof, it has produced reasonably good results and enabled us to save hundreds of man-hours in duplicating templates.

The off-set litho process was developed by Curtiss-Wright several years ago as a fast and economical means of supplying sub-contractors with copies of templates required in the production of various aircraft parts. It necessitates the utilization of a large rubber-covered steel roller and a flat bed, upon which the roller can be systematically operated by means of a suitable motor.

Loft-scribed plates are inked so as to provide the initial pattern in the form of white lines on a black background, then the rubber-covered roller is rotated over the plates so as to pick up the inked pattern. The pattern is transferred to a blank sheet of metal by the roller, and when the ink is dry the duplicate

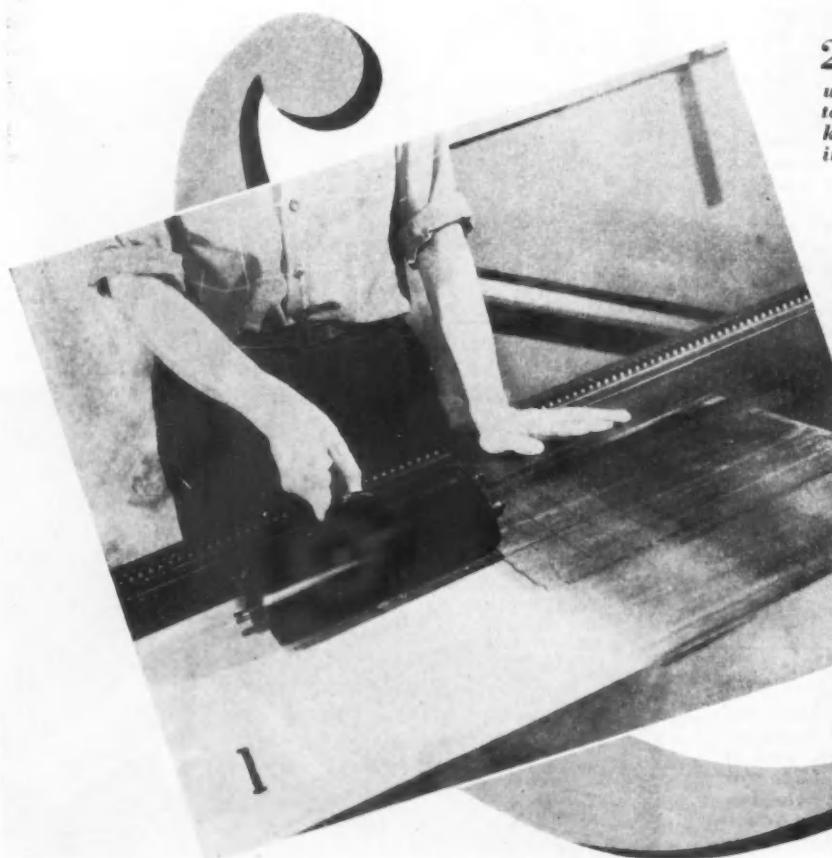
template can be cut from the metal on which the pattern has been reproduced.

Extensive research convinced Convair engineers that this was the simplest, fastest, and cheapest of all template reproduction methods; but it failed to solve the problem of mirror images in its initial form. Although it is customary to loft only one side of an airframe (because the other side is merely a mirror image), it was necessary for template makers to utilize separate masters in the reproduction of patterns for the two sides of an airplane. This was costly in both time and money because it necessitated extra hours of scribing time in the loft and additional set-ups in the template reproduction department. Obviously, what we needed was an auxiliary process which would be analogous to the photographic process of reversing a negative.

The problem was finally solved with what we call an "intermediate blanket," which is actually nothing

1. When the template master has been placed in the proper position, using double-coated scotch tape to fasten it to the flat bed of the off-set litho machine, its face is covered with a dense offset black ink.

2. An "intermediate blanket" (a rubber-faced steel pad) can be used in making "mirror image" template reproductions. The blanket is placed over the face of the inked template master, as shown here.



e Reproductions

more than a rubber-faced steel pad. The intermediate blanket was used to pick up the pattern from the scribed original; then, from the blanket, the pattern was transferred to the rubber-covered roller and to the blank sheet of metal in the usual manner.

The mirror image patterns are not generally as clear as the patterns reproduced by the original off-set litho process; but, if sufficient care is exercised, they are consistently adequate.

3. When the template pattern has been transferred to the intermediate blanket, it is picked up by the surface of the rubber-covered roller of the off-set litho machine.

4. The Mirror image template pattern is transferred to the blanket sheet of template stock by the rubber-covered roller in the usual manner. Such patterns are not generally as clear as the patterns reproduced by the original off-set litho process; But, if sufficient care is exercised, they are consistently adequate.

Methods of testing are herewith quoted from an official Consolidated Vultee report:

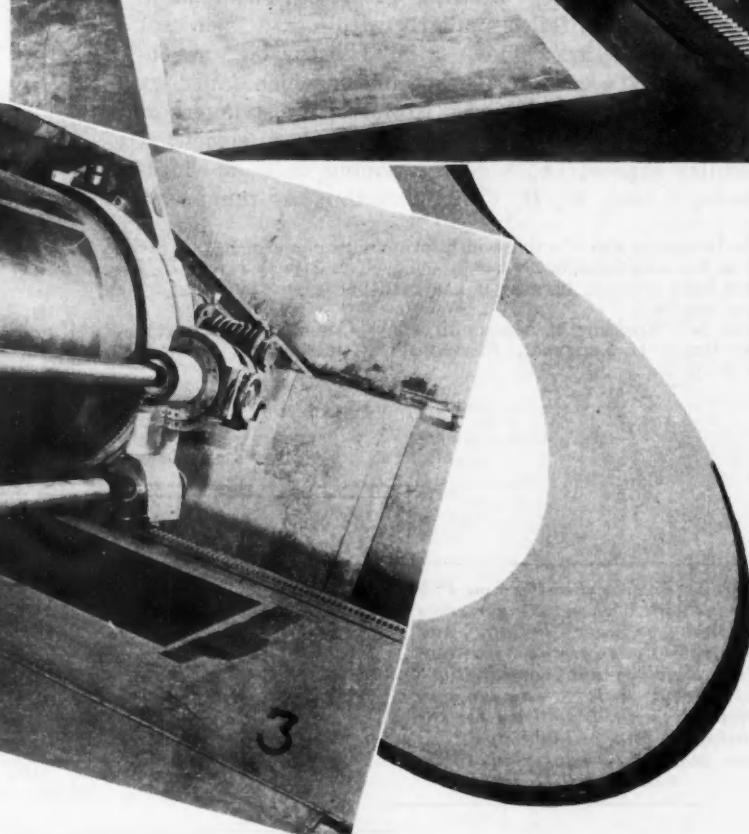
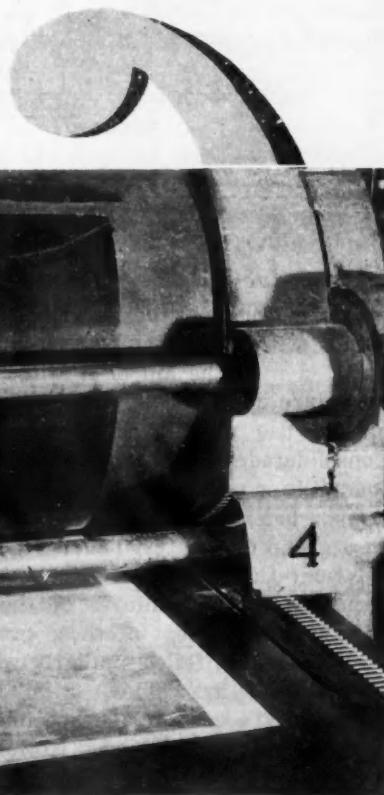
"Contact: The scribed original was fastened to the press bed with double-coated Scotch tape and inked in the usual manner. A clean sheet of metal was then

placed over the original and the press cylinder rolled over them. Sufficient ink was transferred from the original to the clean metal to produce a usable mirror

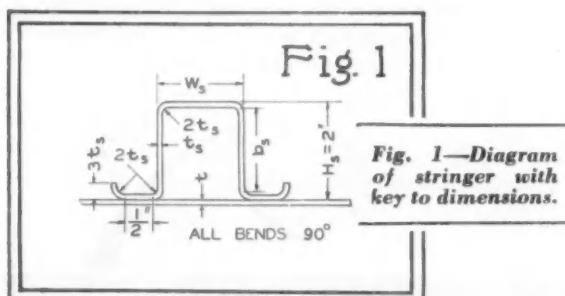
(Turn to page 62, please)

By C. F. Reupsch

Assistant Chief of Manufacturing Research, Consolidated Vultee Aircraft Corp.



Design of Hat-Type Plate



I—Introduction

Charts for the study and selection of compression panels stiffened by hat-type stringers have been constructed with the aid of a semi-rational computation procedure described* in Reference 1. In the investigation, use was made of column curves given in Consolidated Vultee Report No. SG-984. Since the computation method involves certain empirical assumptions, a brief discussion of its accuracy is appropriate. In a group of 150 test panels studied by the National Advisory Committee for Aeronautics, 51 per cent experienced column failures of the stringers at loads within ± 5 per cent of those predicted; the remaining 49 per cent failed similarly within ± 10 per cent of the computed values. Similar accuracy was obtained in the case of 100 specimens which failed by crippling of the stringers. However, the stringers of the latter group of specimens all had somewhat similar shapes; i.e., 3 degree sloping walls, a width-to-depth ratio W_s/H_s (Fig. 1) within the range 0.65

*—Instead of the effective-width formula proposed in Ref. 1, the Von Karman formula $2W_1 = b_1 \sqrt{\sigma_{cr}/\sigma_m}$ or $2W_2 = b_2 \sqrt{\sigma_{cr}/\sigma_m}$ has been utilized, because it has been better substantiated by test results.

Ref. 1—"Buckling of Aluminum Alloys Columns and Plates", by Henry L. Langhaar, *Journal of the Aeronautical Sciences*, Vol. 10, No. 7, July 1943.

to 0.75, and flanges with lips at least $2t_s$ high. Some 50 specimens whose width-to-depth ratios W_s/H_s were equal to 1.00 showed considerable scatter in the stringer cut-off stresses, the worst result being 28 per cent less than that predicted. It is therefore believed that the procedure used for computing stringer crippling stresses is limited to certain general shapes, and that its application to a stringer of unusual proportions should be corroborated by test. For stringers with 25 degree sloping walls, the method has been substantiated by a few tests.

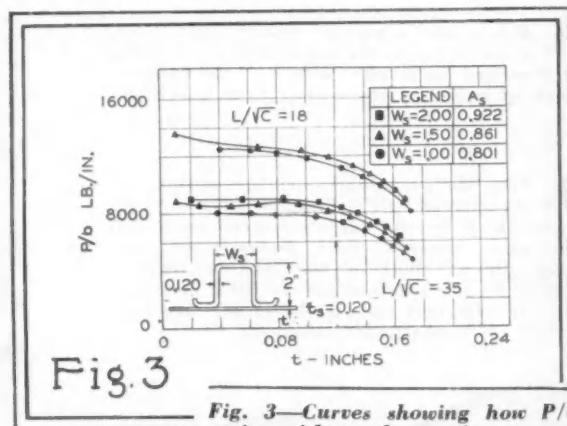


Fig. 3—Curves showing how P/b varies with t when stringer cross section, stringer length, and equivalent gage are held constant for plate-stringer combinations of Alclad with yield stress in compression of 64,000 psi for the stringer and 57,000 psi for the plate. The equivalent thickness t_e is 0.24 in.

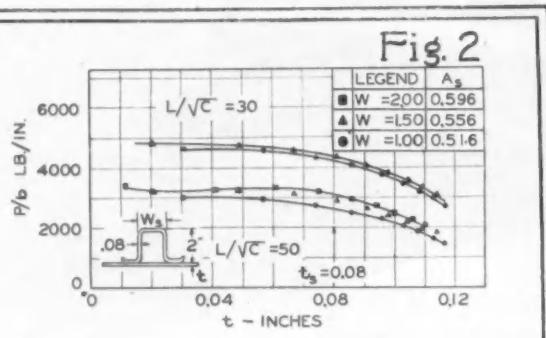
In the construction of the design charts described in the following, discrepancies between calculated and observed crippling stresses are avoided because the

designs are such that the stringers will definitely fail as columns. Therefore, the computation procedure by which the charts were obtained is believed to be as accurate as the physical data upon which aeronautical designs are based.

II—Effects of Stringer Shape and Plate Thickness

In the following dis-

Fig. 2—Curves showing how P/b varies with t when stringer cross section, stringer length, and equivalent gage are held constant for plate-stringer combinations of Alclad with a compression yield stress of 42,000 psi for the stringer and 40,000 psi for the plate. The equivalent thickness t_e is 0.16 in.



e - Stringer Combinations

cussion, the notation given in Fig. 1, is used, together with the following:

A_s , cross-sectional area of a stringer.

ρ , radius of gyration of entire plate-stringer cross section.

L , length of plate-stringer combination. (in a wing, this is the bulkhead spacing).

b , stringer spacing.

P , load per section to cause failure. (a section is the cross-section of one stringer and that of the symmetrically-located strip of plate of width b).

C , end-fixity constant for the plate-stringer combination.

In general, a plate-stringer combination is designed to transmit a prescribed average load per chordwise inch, P/b , over a given reduced span, L/\sqrt{C} . Of a class of plate-stringer combinations which will meet this requirement, the most efficient is the one having the least weight. Conversely, of a class of plate-stringer combinations of the same weight and the same reduced length, the most efficient is the one which will carry the greatest load per chordwise inch, or the greatest average stress. The restriction of comparisons to plate-stringer combinations of the same class is here emphasized because of the tendency to compare specimens indiscriminately on the basis of average stress alone. The lack of significance of such comparisons is

By Henry L. Langhaar,
Consolidated Vultee Aircraft Corp.

illustrated by the observation that solid 2-by-4-in. rectangular stringers are excellent when judged by stress capacity.

As a measure of the weight of a plate stringer combination, the following ratio is adopted:

$$t_e = (A_s + bt)/b = t + A_s/b \dots \dots \dots (1)$$

In the above, t_e is the average cross-sectional area per chordwise inch; it is called the "equivalent gage," because it is the thickness of a flat plate of the same length, width, and weight as the plate-stringer combination. The average stress carried by the plate stringer combination is evidently

$$\sigma_{av} = P/(bt_e)$$

For numerical studies of stringer-shape effect, 18 basic stringers were selected, of the proportions shown in Fig. 1. The stringers are sub-divided into three

Fig. 4

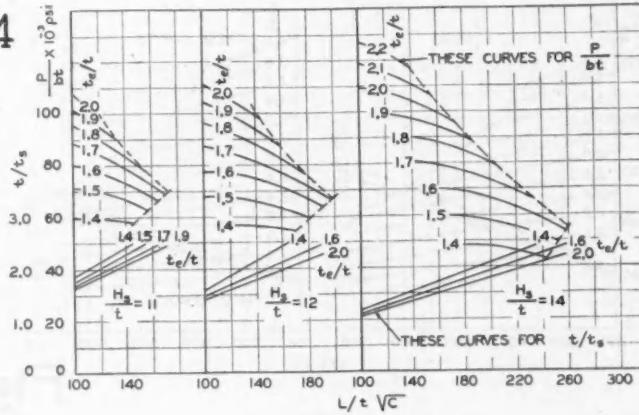
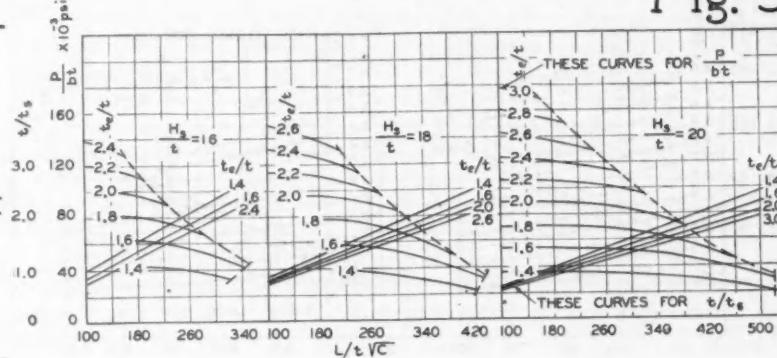
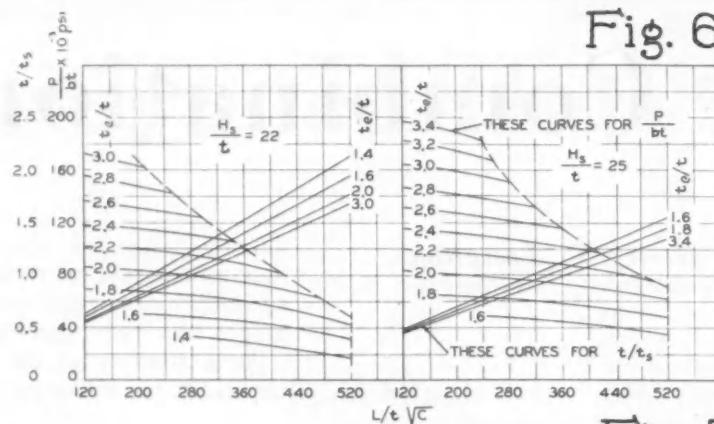


Fig. 5



STRINGER $F_{cy} = 64,000$ psi
24S-T84
PLATE $F_{cy} = 57,000$ psi
24S-T81
5% CLADDING ON EACH SURFACE
 $W_s/H_s < 0.75$
 $b = \frac{A}{t_e - t}$

Fig. 6



STRINGER $F_{cy} = 64,000 \text{ psi}$
 24S - T 84
 PLATE $F_{cy} = 57,000 \text{ psi}$
 24S - T 81
 5% CLADDING ON EACH SURFACE
 $W_s/H_s < 0.75$

$$b = \frac{A}{t_e - t}$$

Fig. 7

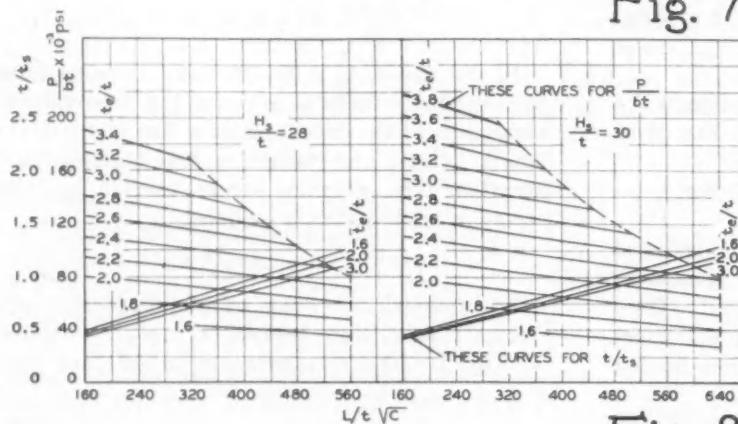


Fig. 8

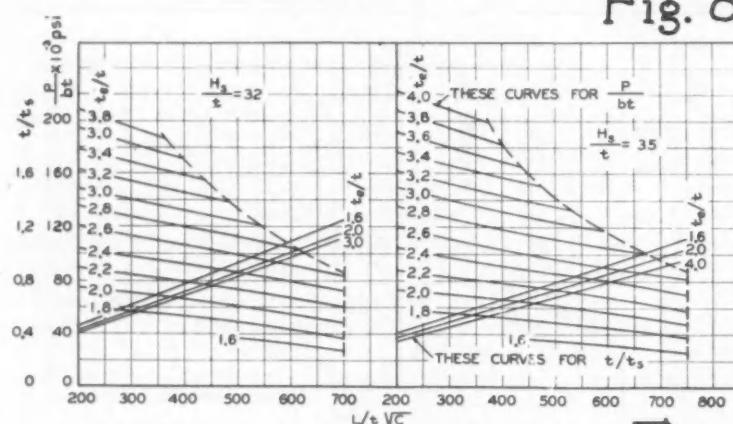
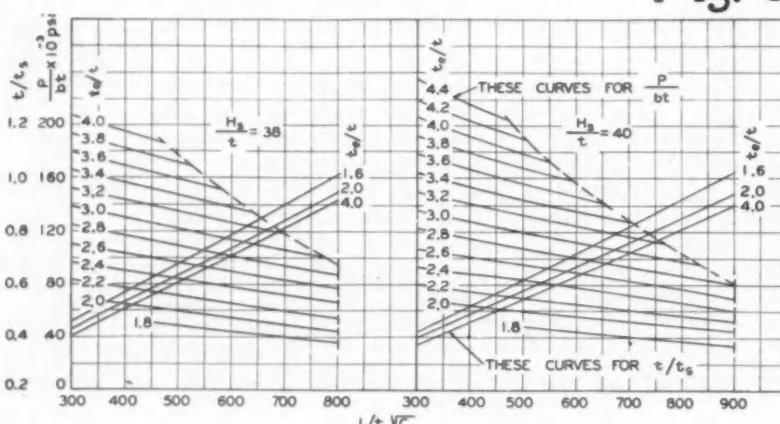


Fig. 9



sets of six each, with aspect ratios (W_s/H_s) of $\frac{1}{2}$, $\frac{3}{4}$, and 1 respectively.

For classes of basic stringers with aspect ratios of $\frac{1}{2}$ and $\frac{3}{4}$, the 22 combinations shown in Table I were studied. For the third class, with an aspect ratio of 1, the shorter lengths were omitted, because the computation procedure does not reliably determine the crippling stresses for square stringers. In each case, the shorter length in Table I is chosen to approach the cutoff on the stringer column curve, while the greater length is chosen to give a decided column failure. Although only stringers of 2-in. depth were studied, it is generally true that only ratios of dimensions are significant, and all ratios can be varied while one dimension is held constant. Hence, the comparative results apply to stringers of all depths.

TABLE I

| t_s | L/\sqrt{C} | t_e |
|-------|--------------|-------|
| 0.040 | 64 | 0.100 |
| 0.060 | 42 | 0.150 |
| 0.080 | 30 | 0.200 |
| 0.120 | 18 | 0.300 |
| 0.140 | 15 | 0.360 |
| 0.160 | 12 | 0.420 |
| | | 0.330 |

For each combination of length, equivalent gage, and stringer type listed above, a sequence of stringer spacings b was selected. The corresponding sheet thicknesses t were computed by equation (1), and

the load capacities P/b were computed by the method described in Art. I. Computations were performed for 24S Alclad with 5 per cent cladding on each surface, both artificially aged and as received. The following compression yield stresses were adopted:

24S-T81 plate, 57000 psi.
24S-T plate, 40000 psi.
24-S-T84 stringers, 64000 psi.
24S-RT stringers, 42000 psi.

For the 18 basic stringers, with the combinations of plate and stringer dimensions listed above, curves of P/b vs. t were plotted. Since all of these curves have the same general form, only two of them are here reproduced (Figs. 2 and 3). In studying these charts it is important to note the parameters that were varied, for otherwise erroneous conclusions may be drawn. For each curve, the *stringer dimensions*, the *equivalent gage*, and the *reduced length* are constant. The consistent drooping of the curves shows that for a given equivalent gage, maximum load capacity is obtained with a light skin gage. However, it does not show that either the load, or the average stress is reduced by increasing the skin gage alone, since the constancy of t_e does not permit the variation of t without a simultaneous variation of b . In general, it is found that plate thickness has little effect on the efficiency when $t < t_s$, but that the efficiency drops when $t > t_s$. A good structural rule to follow,

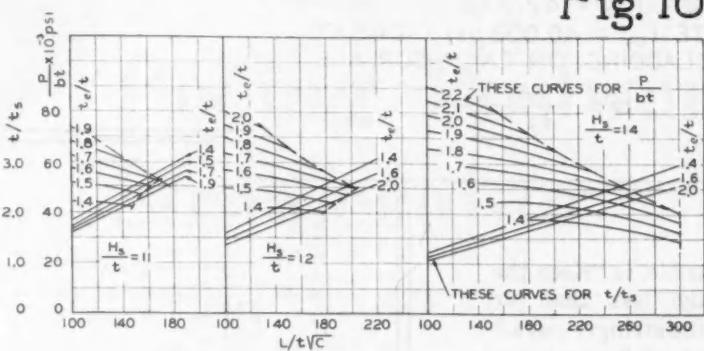


Fig. 10

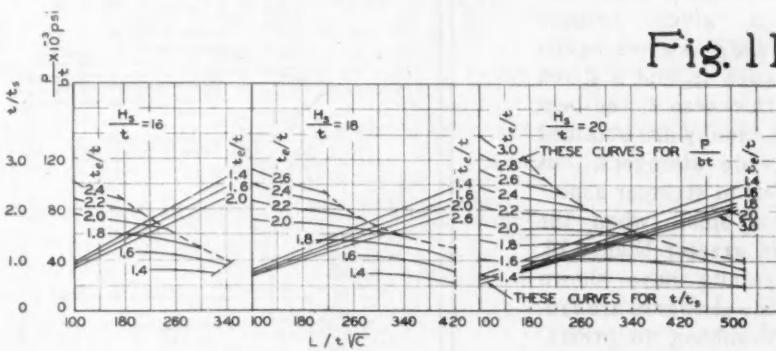


Fig. 11

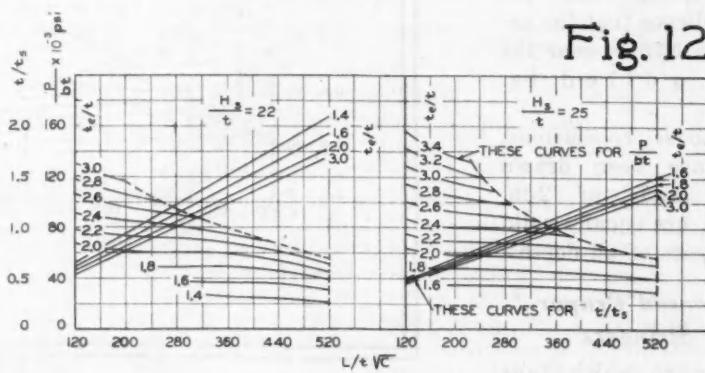


Fig. 12

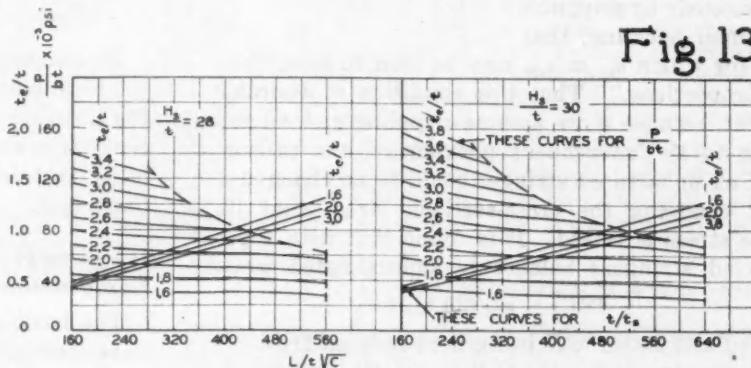


Fig. 13

STRINGER $F_{cy} = 42,000 \text{ psi}$ 24S-RT
PLATE $F_{cy} = 40,000 \text{ psi}$ 24S-T
5% CLADDING ON EACH SURFACE

$$b = \frac{A}{t_e - t}$$

STRINGER $F_{cy} = 42,000 \text{ psi}$ 24S-RT
 PLATE $F_{cy} = 40,000 \text{ psi}$ 24S-T
 5% CLADDING ON EACH SURFACE

$$b = \frac{A}{t_e - t}$$

when feasible, is "Keep the plate gage less than or equal to the stringer gage."

Figs. 2 and 3 show that with a given reduced length $L\sqrt{C}$, a given equivalent gage t_e , and a given sheet thickness t , the best results usually are obtained with wide stringers, but the effect of stringer aspect ratio is small when the ratio is greater than 0.75. Test results have shown that wide stringers are frequently subject to premature crippling, and the writer believes that the aspect ratio 0.75 is near the idea for rolled hat stringers.

The above conclusions, which have been drawn from a study of 2-in. stringers, are equally valid for stringers of all depths.

III—Balanced Proportions for Stringers

A stringer which fails simultaneously by crippling and column buckling, that is, one for which $\sigma_{so} = \sigma_{sf}$, may be said to have "balanced proportions." That this condition is desirable is evident, because if we assume crippling and column buckling to be independent phenomena, the proportions of an unbalanced stringer could be so changed—without changing the cross-sectional area—that its ultimate stress is raised. It is found that with 5 per cent alclad stringers balance is approximated when

$$\frac{L}{(\rho\sqrt{C})} = \pi b_s / (2.1 t_s),$$

the edge-fixity factor \sqrt{K} being here reduced from 2.3 to 2.1 to compensate for the alclad coat. This reduces t_s to the thickness of the core. However, because of the scatter observed when the design approaches the cut-off point, it is believed to be inadvisable to attempt to obtain perfect balance.

The following relation gives the thinnest stringer walls that can be used with assurance of "column failure," and is therefore recommended for practical design:

$$\frac{L}{\rho\sqrt{C}} = \pi b_s / (1.8 t_s) \dots \dots \dots (2)$$

Fig. 14

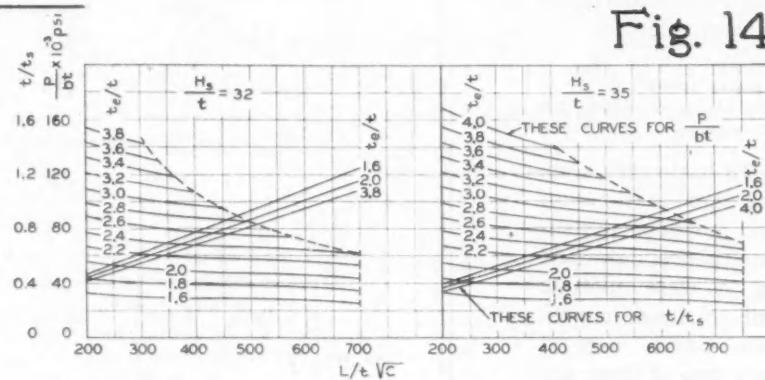
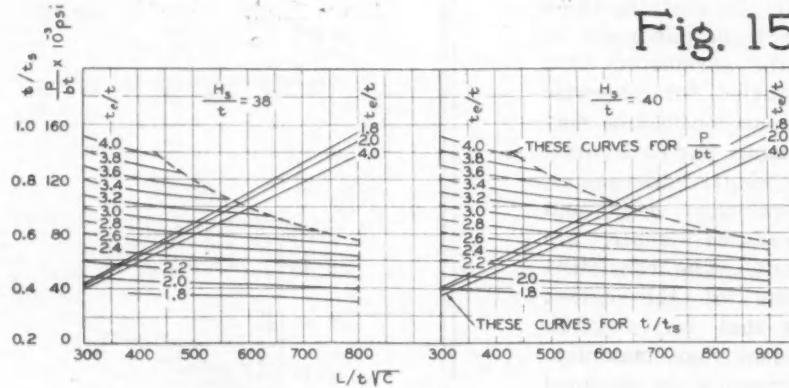


Fig. 15

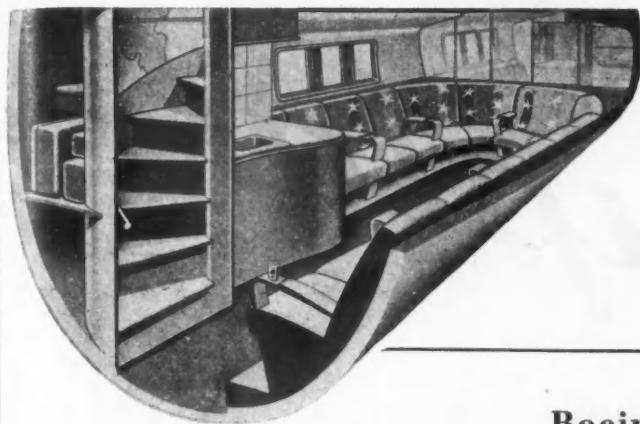


By computations it was found that by dropping from the ideal balance factor 2.1 to the proposed factor 1.8, the ultimate stress is reduced approximately two per cent. This small loss is inconsequential, but the reliability that is insured by fixing the type of failure is important.

IV—Design Charts for Hat-Type Plate-Stringer Combinations

The basic stringers of Art. II with $W_s/H_s = 0.75$, were used for constructing design charts. These stringers are typical of most conventional rectangular rolled hat stringers. As pointed out in Art. II, within the usual design range, the effect of stringer aspect ratio is small. Also, small deviations from the flange proportions shown in Fig. 1 have only slight effects on radii of gyration. Therefore, the charts presented herein will apply quite generally. No design criteria are given for stringers with sloping walls, but it has been found by experimental and numerical studies that

(Turn to page 103, please)



(Above) Lounge and observation room in lower deck.

(Below) Berth arrangement in main cabin.

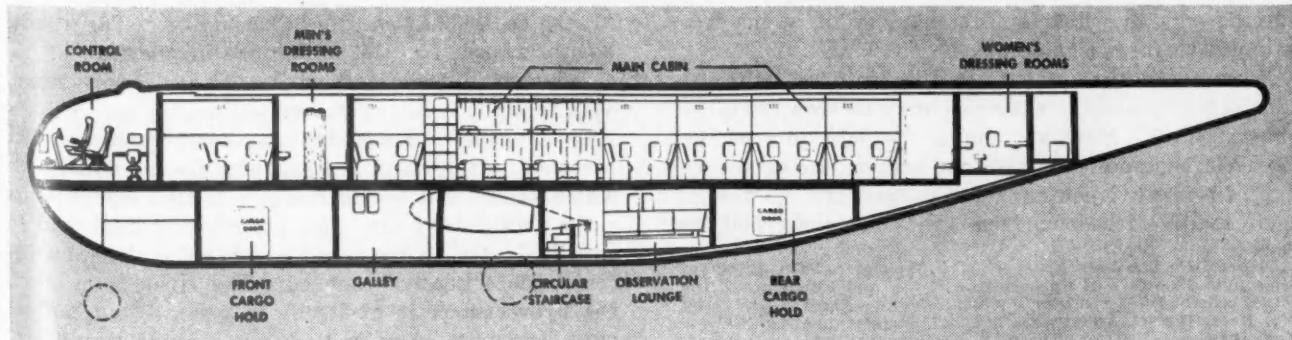
Boeing Postwar Stratocruiser

Boeing 377 Specifications

| | |
|----------------------------|--|
| Wing spread | 141 ft. 3 in. |
| Length | 110 ft. 4 in. |
| Height | 33 ft. 3 in. |
| Weight, empty | 70,000 lb. |
| Weight, gross | 130,000 lb. |
| Weight, landing | 105,000 lb. |
| Power..... | 4 engines of 3500 hp each at takeoff (2800 rated hp) |
| Maximum speed | 400 mph |
| Cruising speed | 340 mph |
| Operating range | 3500 miles |
| Operating ceiling | 30,000 ft. |
| Passenger capacity..... | Special day version: 100 passengers. Luxury sleeper; 36 berths (or 72 day seats), plus 14 lounge seats |
| Cargo capacity..... | Passenger version: 750 cu. ft. (86 passenger seats). All-cargo version: 3000 cu. ft. usable space, max. cargo payload of 35,000 lb. |
| Propellers..... | 4-blades, 16 ft. 7 in. diameter |
| Landing gear.... | Tricycle gear with dual wheels throughout |
| Wing..... | Boeing "117" (Same as Boeing B-29) |
| Tail surfaces.. | Same as Boeing B-29 Superfortress |
| Fuselage..... | Maximum cross-section: Height—15 ft. 9½ in.; Width—11 ft. |
| Main Passenger cabin..... | Length—60 ft. |
| Cabin..... | Completely supercharged except for tail storage area. (When flying between 8000 and 30,000 ft., atmospheric conditions in the cabin are maintained at an 8000 ft. basis) |
| Crew.... | Transcontinental: 3 members in operating crew; two in steward's department. Trans-ocean: 4 members in operating crew; 3 in steward's department |
| Direct operating cost..... | Passenger version: 1 cent per passenger mile. All-cargo version: 5 cents per ton-mile |

BOEING'S postwar two-deck airliner, the Stratocruiser designed in day passenger, sleeper and all-cargo versions for transcontinental and transoceanic service, is a direct outgrowth of the B-29 Superfortress design, having identical wings, tail surfaces and landing gear, but the volume of the Stratocruiser is more than twice that of the B-29 and the fuselage is 12 feet longer. The lower deck of the Stratocruiser has the same diameter as the B-29 fuselage while the upper deck is slightly larger with a width of over 11 feet. The all-cargo version has a drive-up ramp at the rear and internal cargo-handling equipment. A military prototype of the Stratocruiser now is undergoing tests, the current output being assigned to military service. Important Stratocruiser data have been compiled on this page.

Cutaway drawing of sleeper model.



Triptane,

FUEL is as much a part of the engine as the pistons or the valves, and one cannot work either with fuel or engines without taking the other into account. Many years ago it became evident that the fuel problem had two factors which are important. The first is that the specific structure of the fuel greatly influences the knock and the second is that materials can be added to fuel of any structure and likewise influence the result. The researches which discovered the effects of anti-knock compounds, such as aniline and tetraethyl lead, moved back the barrier of knock and the output of internal combustion engines was improved without changing the molecular structure of the fuel used. Subsequent research on fuels themselves showed still more definitely that the limitations of the fuel, from the viewpoint of

knock-free power, resided not in the gross physical characteristics but in its molecular structure, or the specific way in which a fixed number of atoms was grouped to form a molecule.

What the nature of the fuel limitation may be, as illustrated by specific examples, may be seen from the chart, Fig. 1. Here are shown the behaviors of the isomeric heptanes, and also one octane (iso-octane or 2, 2, 4-trimethyl pentane) for comparison, so far as their relative freedoms from knock are concerned, or

This article has been adapted from the paper, "The Effect of Molecular Structure of Fuels on the Power and Efficiency of Internal Combustion Engines," which was presented Sept. 13 by Mr. Kettering at American Chemical Society meeting in New York City.

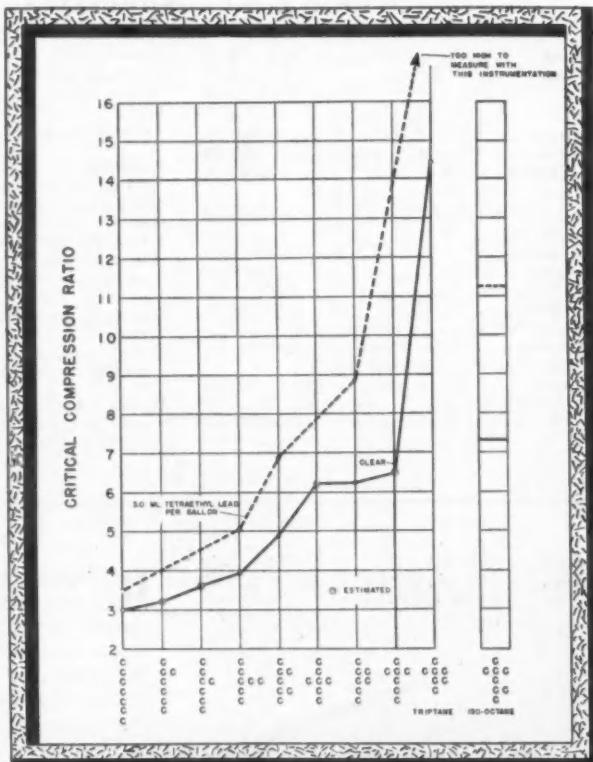


Fig. 1—Knocking characteristics of the heptanes.

General Motors single-cylinder, variable-compression engine
Engine speed—600 RPM
Jacket temp.—212 F
Inlet-air temp.—100 F
Spark advance and mixture ratio—for maximum power, full throttle.

the extent to which each limits the combination of fuel plus engine. The 7 carbon atoms and 16 hydrogen atoms of the heptanes may be arranged in 9 different ways to produce 9 compounds, some of which have very similar physical properties. These are shown by conventional structural formulas along the bottom of the chart, and above each one is represented its critical compression ratio, or the compression ratio which can be used without knock when the engine burns that hydrocarbon as a fuel under a set of standardized conditions. These individual compression ratios cannot be exceeded without the incidence of knock, and if they are greatly exceeded, the eventual destruction of the engine results.

There are three things to be seen from the chart. *First*, there is a fairly regular increase

in the individual critical compression ratios as the structure of the molecule of heptane becomes more closely centralized or highly branched. The fundamental reason for this difference in the way hydrocarbons of different structures burn is not known, even though it has been, and still is, the subject of a large amount of research. A *second* important fact revealed by the chart is illustrated by the dotted line which shows that the increase in critical compression ratio obtained by the addition of tetraethyl lead to each hydrocarbon becomes larger as the structure becomes more highly branched. The freer from knock the hydrocarbon is of itself, in general, but not always, the more effective lead is in making it still bet-

2, a Super Fuel

By Charles F. Kettering

Vice President, General Motors Corp.

ter. The third and most important fact to be learned from the chart is the wide range of compression ratios covered. Iso-octane itself, which is rated at 100-octane number and which is the basis of present 100-octane aviation fuels, is only about half way up the scale. Among the isomeric heptanes, then, there is a compound greatly superior to 100-octane, as well as to normal heptane which is the zero of the octane number scale.

As an engine runs without knock, the efficiency improves with higher compression ratios; consequently, the importance of having fuel that permits of increasing compression ratios. The higher efficiency which is normally expected from Diesel engines is due to the fact that in those engines compression ratios are very

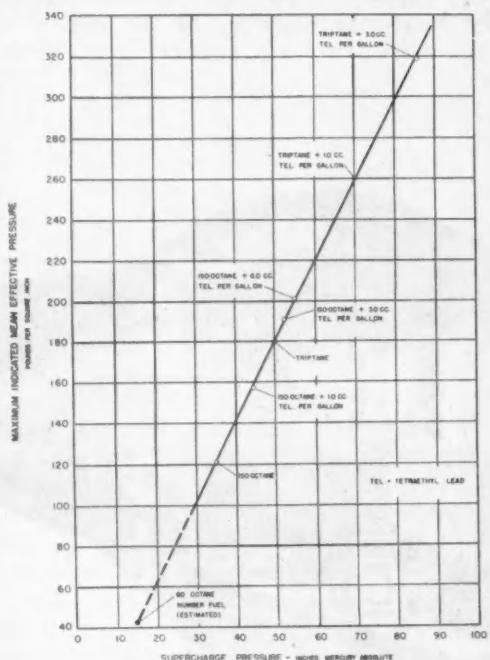


Fig. 2—Performance of fuels.
General Motors single-cylinder supercharged engine
Engine speed—900 RPM. Fuel-air ratio—
0.072-0.0745
Compression ratio—6.5:1. Spark advance—28
deg.
Jacket temperature—200 F. Inlet-air tempera-
ture—250 F.

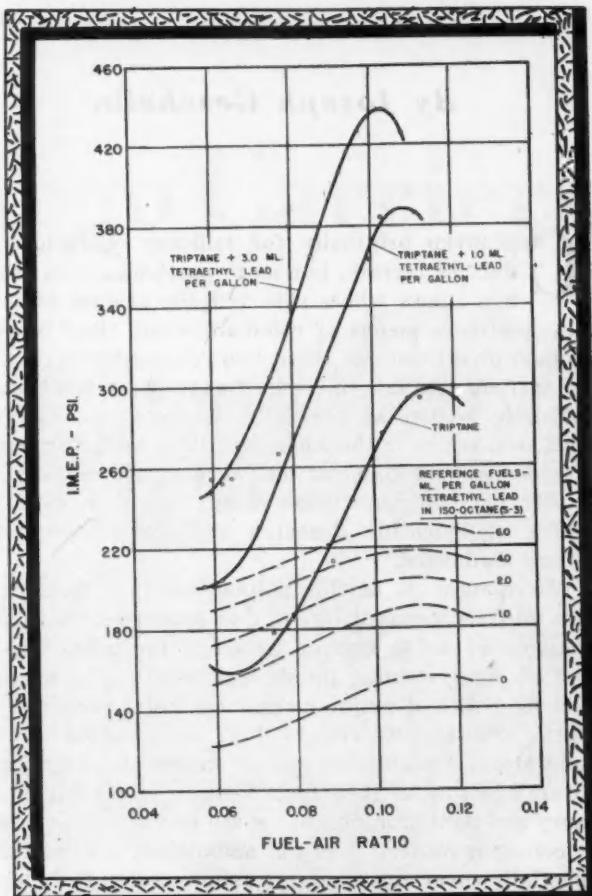


Fig. 3—Knock limited power curves for Triptane.

General Motors single-cylinder, supercharged engine
Engine speed—900 RPM
Compression ratio—6.5:1
Spark advance—28 deg.
Inlet-air temperature—250 F
Jacket temperature—300 F.

high and consequently the expansion ratios of the burned gases are best for economy. Relatively recent experimental work indicates that with a fuel of high order of anti-knock value specific fuel economies can be obtained in spark plug engines equivalent to that of Diesels.

Triptane

The outstanding thing about the heptanes is the behavior of 2, 2, 3-trimethyl butane, or triptane. As was shown by engine tests run a good many years ago, trimethyl butane is one of the best fuels known in respect to degree of freedom from knock. It is so good that when leaded it is beyond the capacity of some methods of measuring its quality, as indicated by its relation to our present standard, iso-octane.

It is possible, however, to look at this special heptane from another standpoint—that is, not in terms of compression ratio, which represents gains primarily due to increases in efficiency, but from the standpoint of gains by supercharging, primarily increases in power. Fig. 2 shows the knock-limited power obtainable from a particular but probably fairly representa-

(Turn to page 92, please)

By Joseph Geschelin

Studebaker

CONCEIVED originally for military operations on difficult terrain, but more particularly on trackless snows where skis and dog sledges afforded the only sure means of communication, the "Weasel" was in production for about two years prior to its public introduction late in 1944. By that time, the Weasel, officially known as the M-29 Army Cargo Carrier, had seen action in the Aleutians, Italy, and Normandy. Its design and construction were developed cooperatively by The Studebaker Corp., working with the Office of Scientific Research and Development, and Army Ordnance.

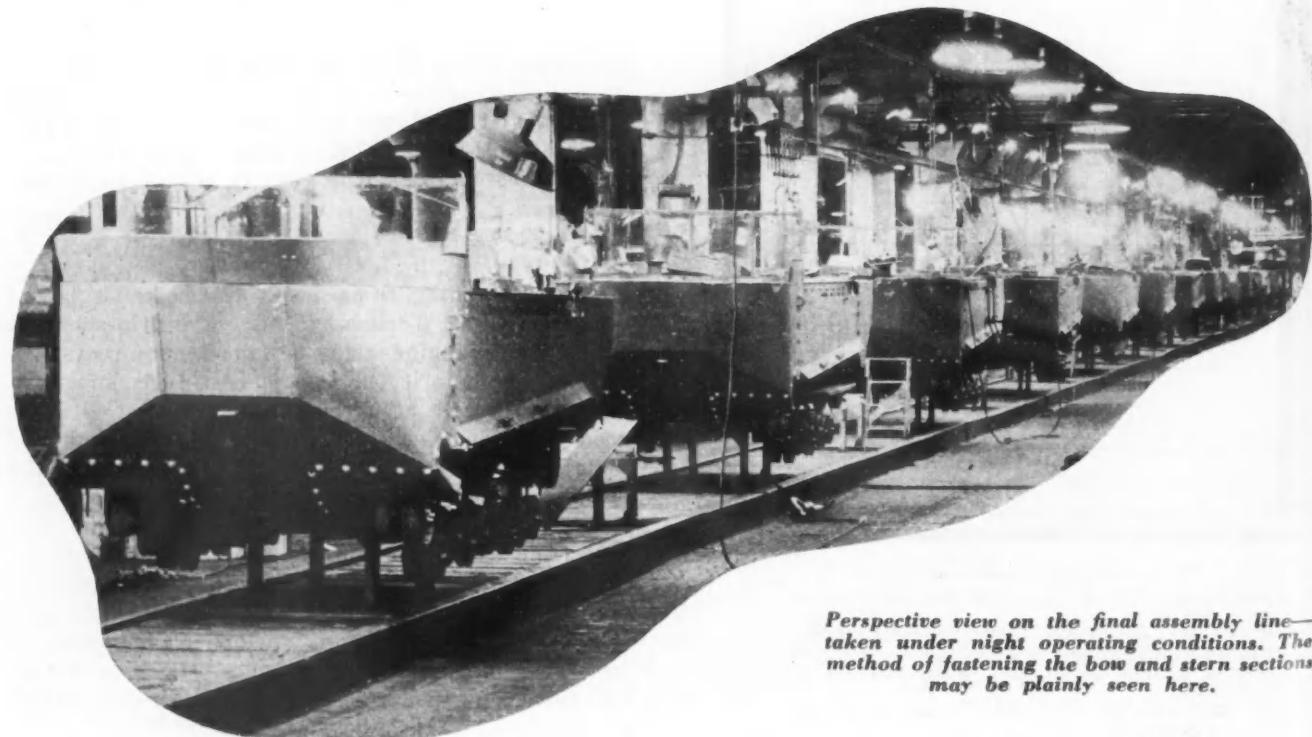
More recently, as this unique vehicle demonstrated its military capabilities, it was converted to an amphibian so as to extend its scope for operations in water, mud, swamp, brush, and sand. The original oblong hull and major mechanical units remained intact. To the watertight hull were added a bow and stern, attached by simple fastenings, increasing overall length to 14½ feet, thereby increasing buoyancy and permitting higher speed and more responsive steering in water. For the amphibian, special skirts partially cover the tracks to reduce water turbulence. The only mechanical change was the addition of two rudders controlled by cables running from the driver's compartment; and the attachment of a capstan at the bow, driven from the engine.

The amphibious Weasel, the M-29C by type designation, is the one currently produced by The Studebaker Corp. in its South Bend plants. From the

standpoint of automotive manufacturing this project is of intense interest for many reasons. For one thing, the Weasel is powered with the Studebaker Champion powerplant, affording the flexibility and economy of this outstanding motor car engine, and permitting its manufacture over the production lines in existence before the War. The hull is fabricated and finished in the Studebaker body plant; final assembly of the vehicle is handled on the same conveyor lines that formerly produced Champions, Commanders, and Presidents.

Stemming from automotive practice, the Weasel was adapted for mass production methods by sub-division into relatively simple stampings and sub-assemblies which are fabricated in successive stages by the use of portable gun welders, arc-welders, and some torch welding operations. The very simplicity of the arrangement, the smoothness with which the job is done, all point to a skillful management of design and production techniques developed through a proper coordination of these related activities.

Coming to the manufacturing details, we find that most of the stampings that go to make up the hull are produced in Studebaker's press shop, although some items are supplied by outside vendors. In its elementary stage, the assembly of the central watertight hull starts with the narrow, short, fabricated



Perspective view on the final assembly line—taken under night operating conditions. The method of fastening the bow and stern sections may be plainly seen here.

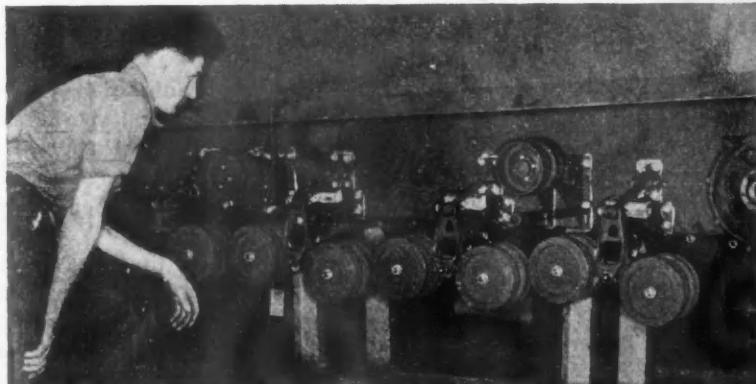
R

Production of M-29C

Amphibious Cargo Carriers

frame section or keel which forms the backbone for the attachment of running gear components. It is made up of formed sections which are spot-welded together in a steel fixture. It may be noted that all spot-welding operations here are made with the use of portable welding guns with energy provided by overhead mounted transformers supplied by Westinghouse, and a few by other manufacturers such as Federal. Many of the welding guns and controls are made by Progressive.

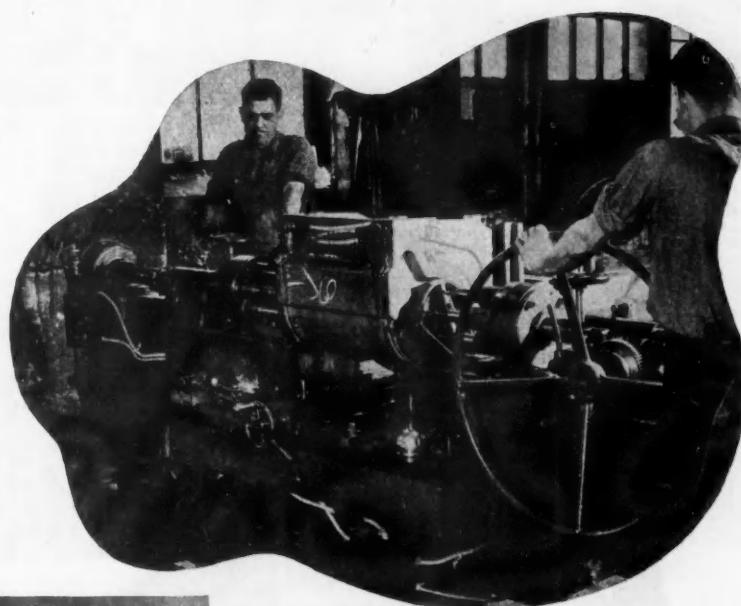
As the frame section is moved from one station to another, there follows the attachment of side panels. All water-tight joints at this stage and later in the devel-



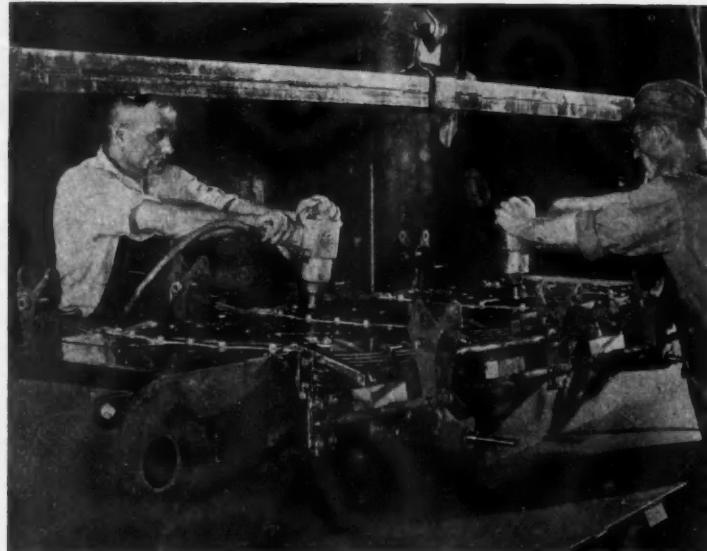
opment of the hull proper are produced by electric arc welding in conventional booths. For these operations the sub-assembly is held in steel trunnion-type fixtures to facilitate the work of the operators. Upon completion of arc welded joints, the flash and scale are removed with portable grinders.

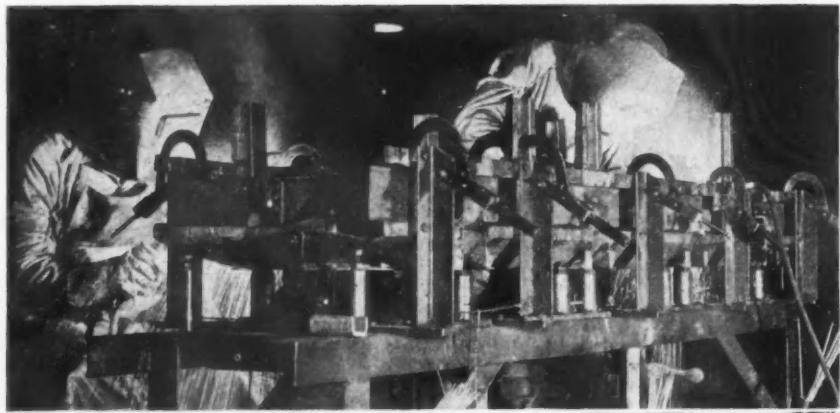
While the frame progresses through the department, the drilling and tapping of holes for various fastenings is performed

In preparation for the final assembly line, leaf springs and brackets are attached to the hull frame as shown.



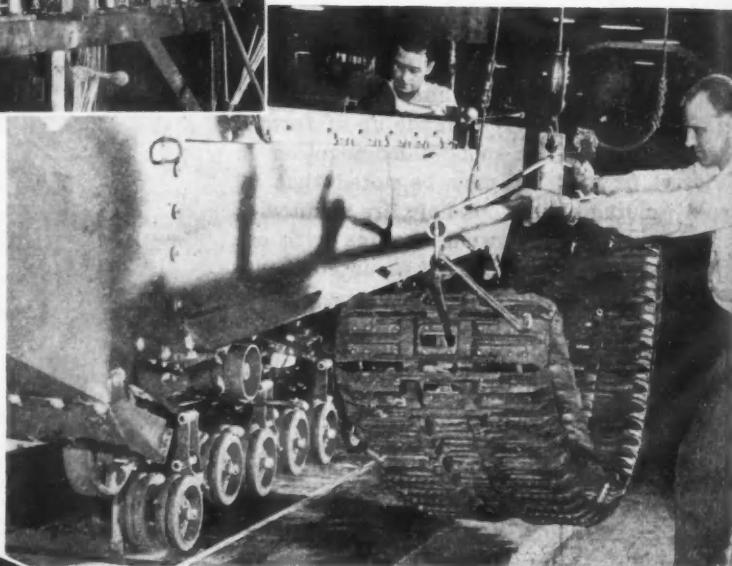
(Above) On the hull fabrication line. Frame and side panel assembly—before integration with the complete hull—is drilled and bored fore and aft for the axle attachments in this four-way Baker drilling machine.





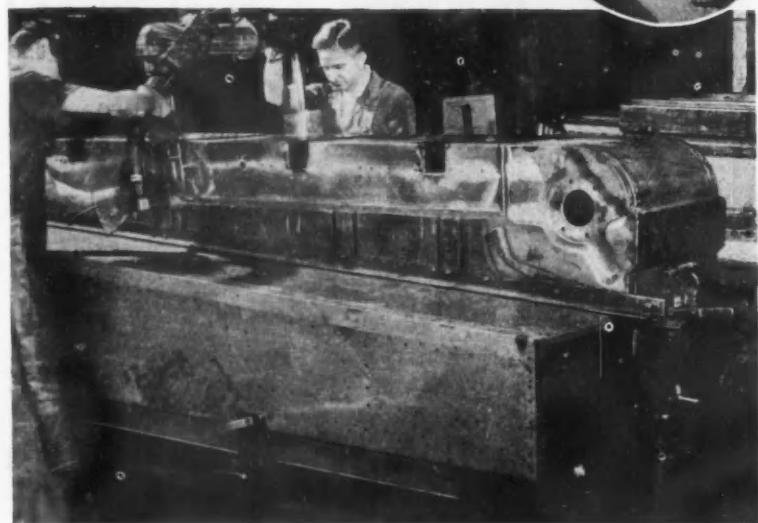
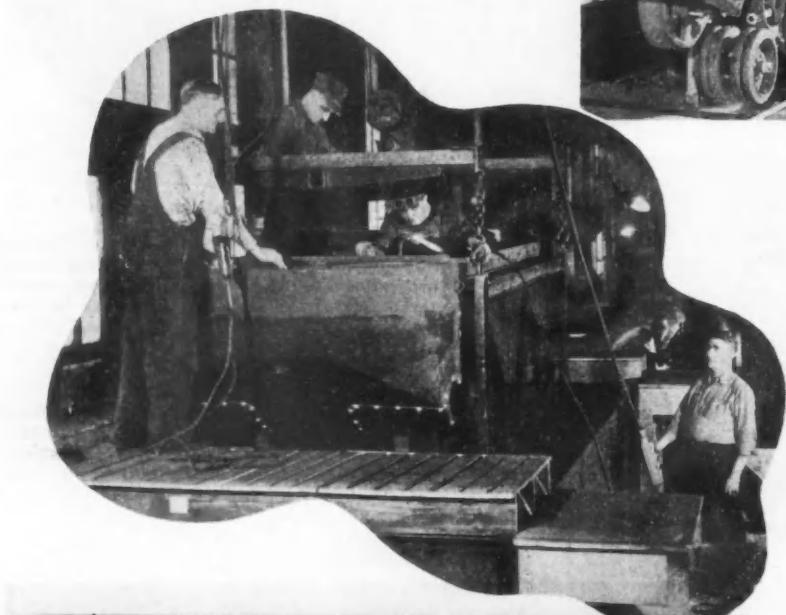
(Left) Watertightness of frame and panel sub-assembly is effected by arc-welding operations such as shown here.

(Below) Nearing the end of the assembly line. Here is the first stage in the installation of the endless track.



(Bottom of page) Spot-welding of frame and side panel sub-assembly, using Progressive gun especially designed for this operation.

(Below) Here is the water bath for testing assembled hulls which come down from an upper floor assembly station. Welder is shown in the act of making a minor repair.



at stations fitted with radial drills. One of the interesting mechanical operations at this point is the special four-way Baker horizontal drilling machine for boring at the front and rear ends for axle attachment.

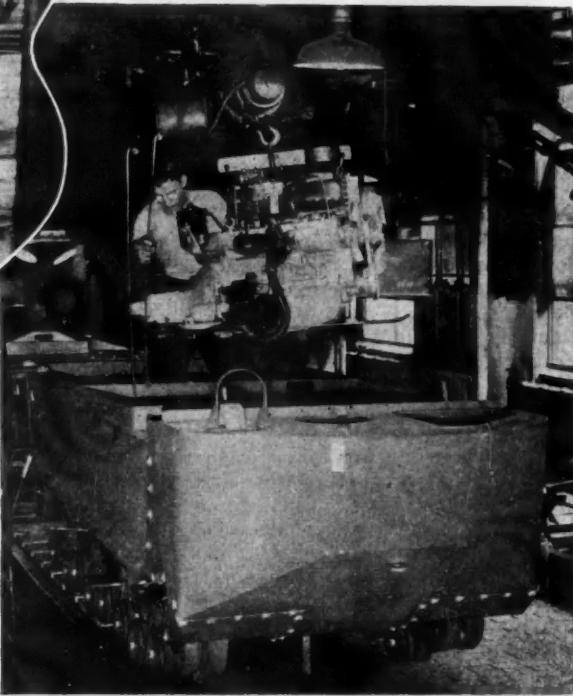
Paralleling the frame line is a short press line for producing hull panels. These are blanked in Toledo presses, formed in a large mechanical press brake. The panels are made up into sub-assemblies and are routed to the frame assembly line for attachment. The frame and panels meet in a massive framing fixture for welding into an integral hull. The hull assembly then continues from station to station—arc-welding of joints, attachment of bulkheads, etc.

The welded hull is now ready to be tested for water tightness. This is done in two stages—first immersion, upside-down, in a liquid soap bath with the interior under air pressure; then immersion in a large water tank. For the latter step the hull is mounted in a steel cradle weighing about 3800 pounds to assist in submerging the hull to its water line. At both stages, trained inspectors go over the hull to spot even the most minute evidence of leaks.

The welding department also handles



(Left) Amphibious Weasels entering the outside bath tub for the final water test under the watchful eyes of Army inspectors.



On the Weasel assembly line—lowering the powerplant into the hull.

the grousers which make up the flexible track for the Weasel. The grousers are made up in the form of two stampings, welded back to back by projection welding on a Thomson welder, handling 20 spots at a time. Following welding, the grousers are shipped to B. F. Goodrich for bonding the rubber tread surface. Goodrich also supplies the rubber-treaded bogie wheels and track idlers.

Meanwhile in the forward section of the body shop, on the same floor, are fabricated the bow and stern sections for the amphibian model. Following the same pattern as for hull fabrication, the bow and stern sections are produced from simple stampings made up, first, in sub-assemblies, then assembled into complete self-contained units. The sub-assemblies go to one of two parallel assembly lines—one for the bow, the other for the stern—for fabrication in steel framing jigs. As in the case of the hull, the assemblies are made up by gun-welding, then the water-tight joints are finished by arc-welding for long seams and by torch welding for smaller and inaccessible joints. Each of the assemblies is tested for water tightness by filling with water under air pressure.

Following fabrication, the hulls, bow and stern sections are moved to the paint shop on the second floor. Here they are mounted on the conveyor, chemically cleaned by hand, and proceed to paint spray booths and drying ovens. Hulls are Bonderized prior to application of the ground coats. The huge Bonderizing unit and its large drying oven, formerly used for treating Studebaker motor car bodies and sheet metal, were installed by R. C. Mahon.

Hull assembly, consisting of the attachment of the bow and stern sections to the hull proper, is done on the fourth floor of the body building. This is a simple, rapid bolting job, using Chicago Pneumatic nut runners, the joints being coated with a sealing compound before attachment. The completed assembly then returns to the main floor for water-testing in a large bath.

The scene now shifts to the final assembly line in the assembly building, where passenger cars were built before the War. First operation before starting

on the assembly conveyor is the installation of four transversely-mounted leaf springs for the bogie suspension. For this operation the hull is held upside-down in a fixture with the springs depressed to facilitate attachment. The hull is then transferred to the assembly conveyor, ready for the installation of the running gear.

From this point on the activity is much like the integration of a motor car. In keeping with this practice, sub-assemblies such as bogies and instrument panels are made up on benches installed at right angles to the assembly line. First comes the installation of bogies, then the mechanical units—powerplant, differential and final drive, propeller shaft connection, cooling system, instrument panel, etc. The rubber track, made up as an endless belt, is installed near the end of the line. This is done by hand with the aid of special bars by a team of four men. They do the job in the twinkling of an eye.

As the assembly operation progresses to the end of the line, there follows the installation of accessories, rudders, capstan, and other items. At the same time the trim department of the body shop prepares the various trim items required to complete the vehicle. At the end of the line, the Weasel is driven off under its own power and goes to the run-in stand and to final inspection before taking off for the road test.

Owing to the possible effect upon water tightness of the assembly operations with their manifold at-

(Turn to page 104, please)

New Products for Aircraft

Brake Intensifier for Aircraft

The aircraft model of the new "Univac" brake intensifier, brought out by PESCO Products Co., Cleveland, Ohio, has been designed to provide a unit for power braking on airplanes to permit faster braking action and lower pedal pressures. The intensifier is particularly suitable for medium size aircraft with special installations available for planes weighing up to 30,000 lb.

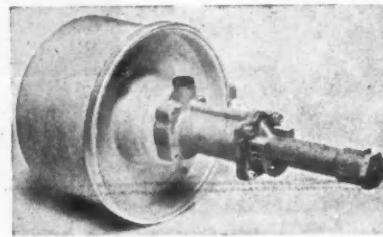
The unit, operating in conjunction with a PESCO vacuum pump mounted on the engine, produces the desired braking pressure at a pedal force of only 50 lb. The unit is connected anywhere in the line between the master cylinder and the wheel brake. It is a completely self-contained unit, weighing five pounds. There is a minimum of piping required and no levers or rods are necessary.

The assembly consists of a vacuum suspended piston connected to another piston in a hydraulic cylinder. When the pilot operates the master cylinder in his hydraulic brake system, thereby producing a pressure in the master cylinder to wheel brake lines, the pressure so produced shuts off the vacuum and admits air to one side of the pis-

ton. This moves the piston in the hydraulic cylinder which forces fluid into the brake lines and increases the line pressure. A control piston co-acts with a vacuum and air valve so constructed as to give an exact ratio of input master cylinder pressure to brake line pressure. This ratio may be approximately four to one. Thus the pilot is relieved of taking the entire brake reaction against his foot.

Arc Welding Electrode for Aircraft Steels

A new high tensile arc welding electrode for fabricating aircraft steels has been announced by the General Electric Company, Schenectady, N. Y. Capable of making a deposit of high



Univac brake intensifier

tensile strength comparable to the mechanical properties of the parent metal, the new electrode, known as Type W-55, is especially designed for use in the manufacture of heavy bombers and transport planes.

Arcing characteristics of the W-55 electrode are said to provide flexibility over a reasonably wide voltage range with stable operation throughout. The arc has sufficient force to keep slag from crowding the electrode when welding vertically downward, and the metal sets up quickly when welding overhead and vertically upward.

Characterized by its gray extruded coating, the W-55 electrode is recommended by the manufacturer for operation on direct-current straight polarity or alternating current. A medium to long arc is recommended for best results. The W-55 is available in three sizes: 3/32 by 12 in., 1/8 by 14 in. and 5/32 by 14 in.

Fire Extinguishing System for Aircraft

American-LaFrance-Foamite Corp., Elmira, N. Y., has developed a fire extinguishing system for aircraft, which uses methyl-bromide as the extinguishing agent and is said to save up to 50 per cent of the weight ordinarily involved. This new electrically-operated system conforms to the requirements of both the CAA and the AAF in the rate and volume of discharge. It protects both the engine and the accessory compartments of the nacelles, and is designed for any multiple number of engines.

(Turn to page 90, please)

Production of Airplanes, Ships, Tanks, and Other Combat Items

July, 1940, through December,* 1944

| Munitions Product | Unit | Total July 1940- Dec. 1944 | July- Dec. 1940 | 1941 | 1942 | 1943 | 1944 |
|---|------------------------------|----------------------------------|--------------------|--------|---------|---------|---------|
| AIRPLANES | | | | | | | |
| TOTAL ALL PLANES | Number..... | 254,850 | 3,770 | 19,459 | 47,860 | 85,830 | 97,831 |
| Bombers..... | 000's Lbs. Airframe Wt. | 2,012,478 | 13,799 | 81,144 | 278,565 | 857,361 | 983,607 |
| Fighters and Naval Reconnaissance..... | Number..... | 82,453 | 626 | 4,119 | 12,637 | 29,382 | 35,709 |
| Transports..... | 000's Lbs. Airframe Wt. | 1,257,901 | 5,669 | 40,573 | 163,050 | 425,151 | 623,458 |
| Trainers..... | Number..... | 82,547 | 1,162 | 4,940 | 12,240 | 24,739 | 39,468 |
| Communication and Special Purpose..... | 000's Lbs. Airframe Wt. | 420,891 | 3,756 | 17,776 | 54,100 | 126,254 | 219,005 |
| Tanks..... | Number..... | 19,792 | 164 | 533 | 1,984 | 7,013 | 10,098 |
| Motor Carriages for S. P. Guns..... | Number..... | 196,614 | 1,180 | 3,776 | 18,257 | 55,496 | 117,925 |
| Scout Cars, Armored Cars, and Personnel Carriers..... | Number..... | 56,309 | 1,808 | 9,366 | 17,632 | 19,942 | 7,261 |
| Guns and Fire Control..... | Number..... | 126,531 | 3,201 | 18,089 | 39,158 | 47,053 | 19,030 |
| Ammunition..... | Number..... | 13,749 | 10 | 501 | 3,387 | 4,874 | 4,987 |
| Communication and Electronic Equipment..... | Number..... | 10,539 | 13 | 930 | 2,000 | 3,407 | 4,168 |
| TANKS, AND OTHER ITEMS | | | | | | | |
| Tanks..... | Number..... | 75,654 | (a) | 4,258 | 23,883 | 29,462 | 18,051 |
| Motor Carriages for S. P. Guns..... | Number..... | 43,481 | (a) | 1 | 8,265 | 22,235 | 12,980 |
| Scout Cars, Armored Cars, and Personnel Carriers..... | Number..... | 97,236 | (a) | 7,883 | 17,083 | 47,044 | 25,226 |
| Guns and Fire Control..... | Number..... | 9,770 | 84 | 424 | 2,083 | 3,746 | 3,433 |
| Ammunition..... | \$000,000's..... | 16,452 | 98 | 478 | 2,988 | 5,772 | 7,106 |
| Communication and Electronic Equipment..... | \$000,000's..... | 8,843 | 27 | 226 | 1,512 | 3,455 | 4,823 |
| Other Equipment and Supplies..... | \$000,000's..... | 30,496 | 778 | 2,171 | 6,107 | 9,972 | 11,468 |

* Actual through August, scheduled program for the balance of the year.

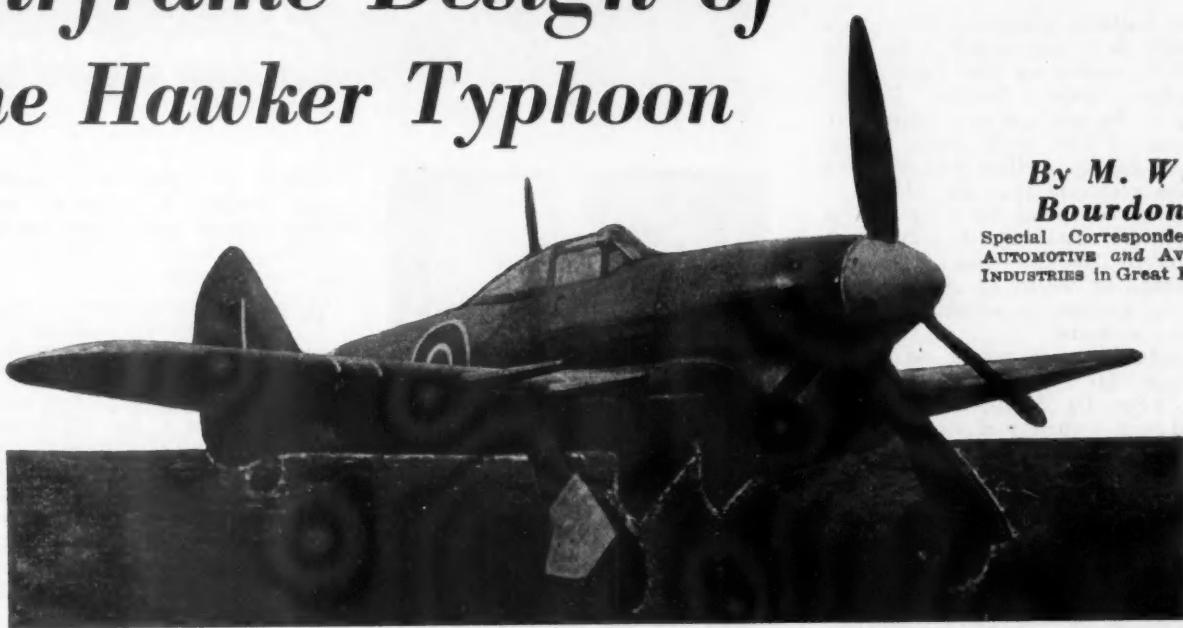
(a) July-December 1940 included in 1941.

All data in above table supplied by Military Division of War Production Board.

Airframe Design of the Hawker Typhoon

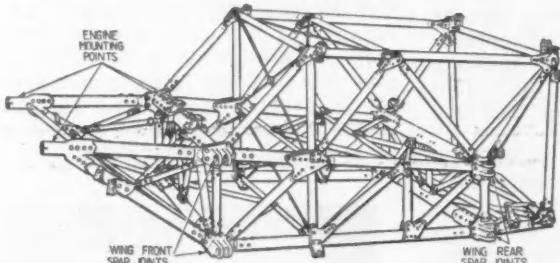
By M. W.
Bourdon

Special Correspondent of
AUTOMOTIVE and AVIATION
INDUSTRIES in Great Britain



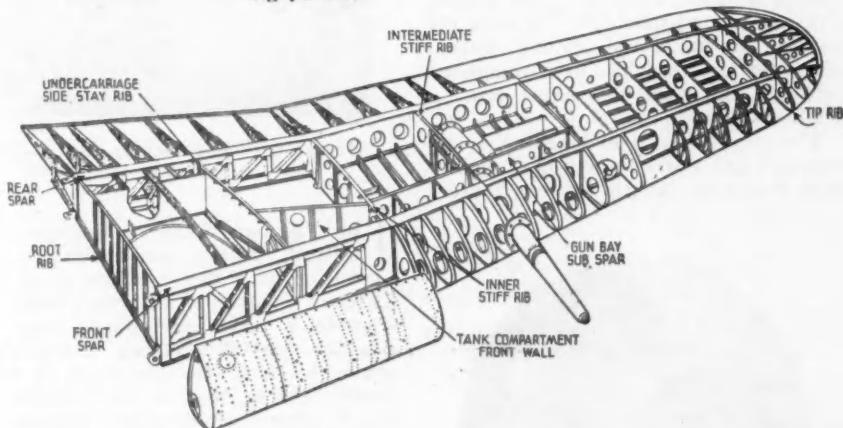
Courtesy of Aircraft Production (England)

Mark 1B Hawker Typhoon equipped with 24-cylinder, 2200 hp Napier Sabre engine.



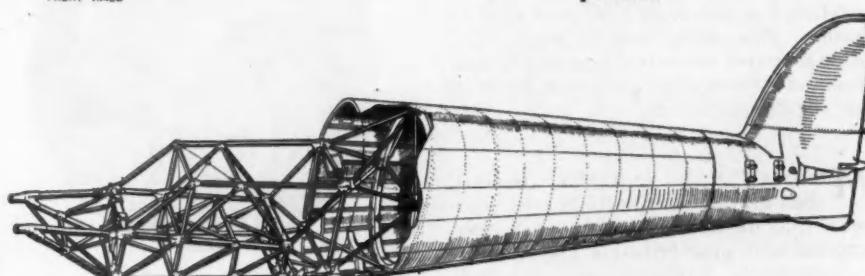
Courtesy of Aircraft Production (England)

(Above) Construction details of center fuselage showing wing and engine mounting points.



Courtesy of Aircraft Production (England)

Structural details of Mark 1B wing (in-board cannon and mounting omitted). With the exception of the detachable tip, the wing is made in one piece and bolted directly to the center fuselage.



Courtesy of Aircraft Production (England)

To supplement the special drawings of Britain's Hawker Typhoon warplane and of the Napier Sabre engine that powers it, and the description of the latter, which were published in the March 1 and May 1 issues of AUTOMOTIVE AND AVIATION INDUSTRIES, we will describe here some of the outstanding design features of the Typhoon's airframe and equipment. For an analysis of the Typhoon airframe, it can be divided into six sections as follows:

(I) Center Fuselage: The principal unit, embodying the cockpit and simple attachments for joining to the other main units.

(II) Engine Mounting: The Sabre engine can be removed by taking out the bolts holding it to the cross bearers.

(III) Wings: Normal two-spar attachment; contain undercarriage, armament and fuel tanks. The ailerons, wing tips and landing flaps are easily detachable.

(IV) Rear Fuselage: Fixed to the center fuselage by a four-point attachment, each point with a single quickly removable bolt.

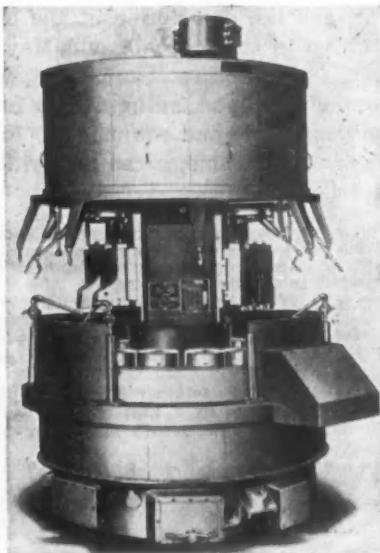
(Turn to page 58, please)

(Below) The Typhoon fuselage showing girder construction in engine mounting and center section with aft monocoque portion.

New Production Equipment

THE Bullard Company, Bridgeport, Conn., is making a new type Multi-Au-Matic known as the Type "DF" Twin 6 and Twin 8 Spindle. The capacity of the new machine places it in the class of 8-in. work where boring, turning, facing, drilling and reaming are the requirements. By means of change gears, speeds from 64 rpm to 583 rpm are obtained, with feeds from .003 in. to .126 in. Chucking is accomplished by means of an automatic chucking mechanism which is adjustable for pressure.

In order to meet tooling conditions, the Type "DF" Twin 6-Spindle and Twin 8-Spindle Multi-Au-Matics are offered with a variety of standard tool heads. The plain vertical tool head is of one piece construction of sufficient width to accommodate duplex tooling, and has 8-in. vertical movement only. The plain compound tool head is a single tool slide mounted on a saddle and also accommodates duplex tooling. Total stroke of this plain compound head is 8 in., which may be applied as vertical movement only or to include a maximum of 4-in. movement of tool slide in either left or right horizontal direction. Where tooling requirements

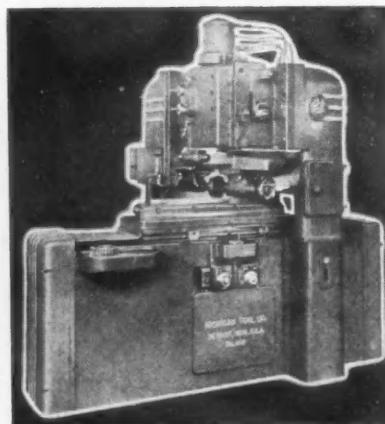


Type DF Multi-Au-Matic

are such that neither the plain vertical nor plain compound tool heads may be used, the universal tool head may be used. This comprises a single tool slide mounted on swivel and saddle and functions vertically, horizontally, or in an angular direction.

MICHIGAN TOOL COMPANY, Detroit, has brought out an improved post-war line of its Series 900 rack-type, crossed-axis gear-finishing machines.

Completely hydraulic in operation, the new Series 900 incorporates two

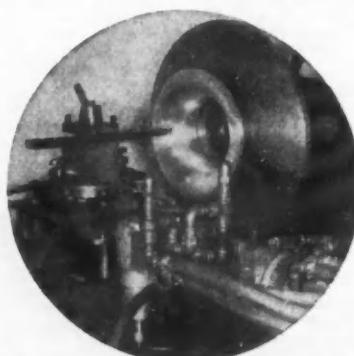


Series 900 gear-finishing machine

separate hydraulic systems, one for the operation of the table, and one for the head feed. Lubricants and coolants have entirely separate outlets, thereby effectively reducing chance of contaminating one by the other and also permitting the ready use of coolant coolers if demanded under extreme conditions.

Improvements have been provided in the control system to facilitate holding tolerances to even closer limits than previously. During the cutting cycle the work is reciprocated at a predetermined rate of speed across the rack while the rack reciprocates longitudinally, in mesh with the work. Controls for both rates of speed are quickly adjustable. In addition, a positive counter is provided to regulate the number of "finishing" strokes desired after vertical feed has been completed to bring the work to correct size on pitch diameter.

The new Series 900 machine is designed to finish gears up to 8-in. diameter with maximum length between centers

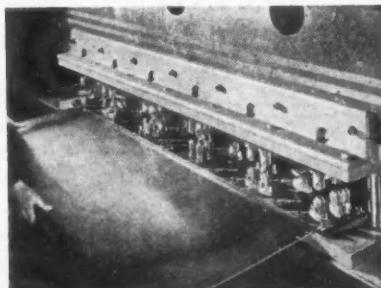


Lathe equipped with Turchan hydraulic follower machine

of 18½ in. The design permits pre-compensating for possible heat-treat distortion of gears subsequent to finishing.

WALES-STRIPPIT CORP., North Tonawanda, N. Y., is introducing the new Wales "CD" hole punching system. This system consists of Wales Type "CD" hole punching units, templates, locator rings, adjustable stops, feed rails and drill templates. With these parts, making a perforating die is said to be a simple assembly job.

Wales Type "CD" Hole Punching Units consist of two parts—punch assemblies and die assemblies which are independent and self-contained for quick mounting to templates, then to die sets, or mounting direct to die sets. The punch assembly consists of a holder which holds the punch, stripping spring and guide in exact relationship to the die assembly which consists of a holder with a built-in slug clearance chute, a die and a pilot pin. The pilot pin in the punch assembly is part of the punch. The same group of units may be used and reused in an unlimited number of set-ups.



Wales "CD" units set up in a press
brake

THE Turchan Follower Machine Co., Detroit, Mich., has released information on a new application of the Turchan hydraulic follower machine whereby a lathe can now be used to machine curved surfaces of variable contours. How the operation is performed can be seen in the illustration which shows a circular magnesium housing, approximately 17 inches in diameter, with 3 different radii and tapers, being machined on a lathe equipped with a Turchan attachment.

Using a master pattern or template as a guide, the attachment follows the contour so exactly that the housing is said to be finished to a tolerance of .001 in. on both the inside and outside diameters.

A NEW electrode holder, designed to allow unobstructed visibility while welding and maximum accessibility even for deep pocket work, fast loading and reloading, plus the feature of more completely using up the electrode, is being offered by the National Cylinder Gas Co., Chicago, Ill.

With the "Shortstub" holder, only one-half inch of electrode is needed for a tight current contact in the holder jaw. An extension of the holder itself allows the now usable stub end of the



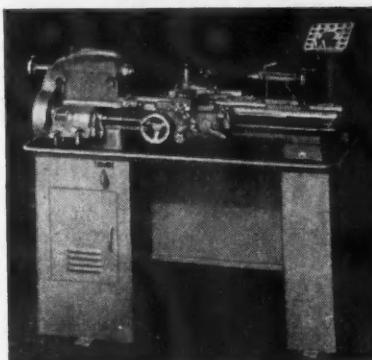
Shortstub electrode holder

rod to be projected into the proper position for welding. The holder, completely insulated, loads and unloads in a second; and because of its balance and light weight, is said to minimize operator fatigue.

THE Corlett-Turner Co., Chicago, Ill., is manufacturing the C-T silent stock tubes for use with automatic screw machines. These tubes, which replace ordinary stock tubes, are engineered acoustically so that they eliminate the banging and clattering of bar stock revolving at high speed in the machine. It is claimed that in closely packed screw machine departments, even when machining hexagonal, square or other "noisy" bars, it is possible to carry on a conversation in a normal voice, where these "silent" stock tubes are used. C-T silent stock tubes can be readily installed on most standard stock stands.

A NEW 9-inch toolroom lathe for exacting toolroom or production operations has just been announced by the South Bend Lathe Works, South Bend, Ind. This lathe has a 9½-in. swing and takes 22 in. between centers. It has a maximum collet capacity of ½ in. and a ¼-in. spindle bore.

The 12-spindle speeds range from 41 to 1270 rpm, with back-gear drive for the lower speeds. A quick change gear box permits cutting 48 pitches of screw threads, 4 to 224 per in.; and provides 48 power longitudinal feeds and power



South Bend 9-in. tool room lathe

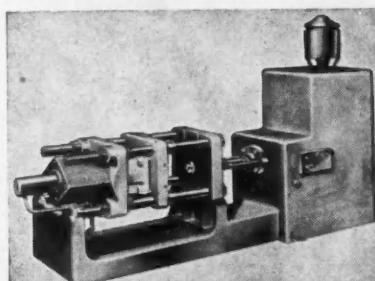
cross-feeds. The lathe is equipped with a handwheel draw-in collet attachment, collet rack, taper attachment, thread dial indicator, thread cutting stop, large and small face plates, and micrometer carriage stop. Additional attachments are available which simplify the machining of special classes of work.

BAKER BROTHERS, INC., Toledo, Ohio, have combined several standard Baker units to produce a unit type, four-way, multiple-spindle driller for drilling axle housings. The machine consists of two standard Baker 7½A14 feed units mounted to right and left on the main horizontal bed, a standard Baker simplified 30-HO vertical hydraulic feed machine mounted on a straddle frame of bridge construction, and another Baker 7½A14 self-contained hydraulic feed unit to the rear and at right angles to the two side units.

The machine will need no alterations for postwar use, as practically the same type axle housings will then be made as are now in production for the Armed Forces.

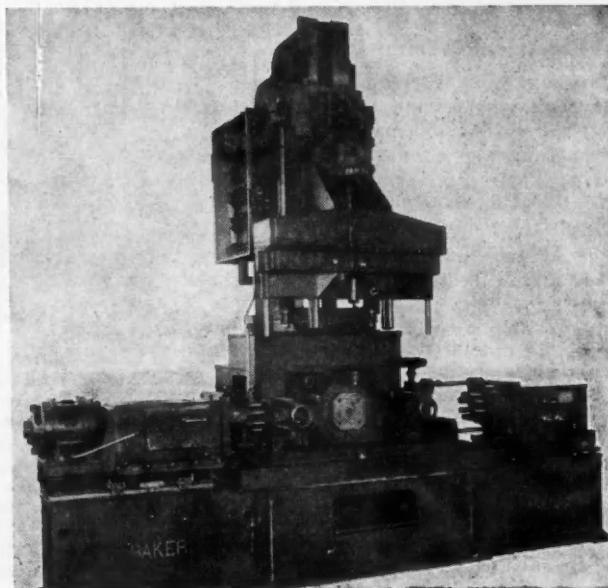
THE H. L. Harvill Manufacturing Company, Los Angeles, Cal., has placed on the market a high-production cold chamber die casting machine intended for use primarily as a machine tool. The equipment is designed to fit into metal-working production lines and is recommended for the use of durable goods manufacturers on the same basis as any other high production machine tool would be utilized in their production.

The Harvill machine is of the high-pressure cold chamber type embodying several new features. The die locking toggle arrangement is said to insure positive die closing, thereby eliminating or substantially reducing the amount of metal flash occurring at the parting line of the dies. An integral two-stage hydraulic system is incorporated in the design, delivering an emulsified water hydraulic fluid at low



Harvill dye casting machine

pressure to operate components of the machine and delivering high-pressure fluid for the injection of aluminum, magnesium and copper base alloys. Pressure of the injection piston on the molten metal may be as high as 88,000 psi, the normal pressure being 35,000 psi.



Bakers four-way, multiple-spindle driller

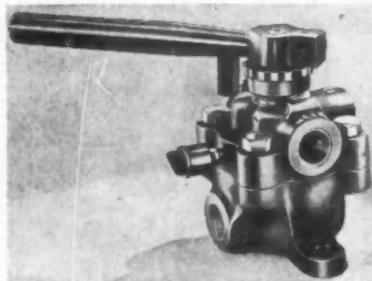
New Products

New Low Pressure Hydraulic Valve

The Galland-Henning Mfg. Co., Milwaukee, Wis., is introducing a new Nopak $\frac{1}{4}$ -in. hand-operated hydraulic valve for use on $\frac{1}{4}$ -in. hydraulic lines at pressures up to 300 psi.

This valve embodies all of the Nopak features and in addition it incorporates a stuffing box with gland nut in the valve-stem assembly.

This feature has been added to prevent seepage of hydraulic fluid at the



Nopak hydraulic valve

valve stem, a condition which eventually develops unless preventive measures are taken. The same construction is also provided in Nopak valves of other sizes for use on low-pressure hydraulic lines.

The new $\frac{1}{4}$ -in. Nopak low pressure hydraulic valve is made in all-bronze construction, with lubricating channels in disc and seat, for water-hydraulic service, and in semi-steel, without lubricating channels, for oil-hydraulic service.

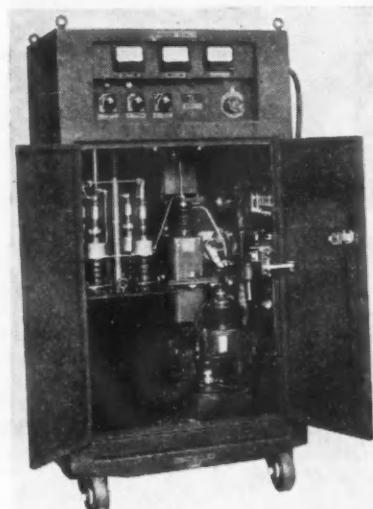
Solderless Repair Kit for Electrical Wiring

Now available to industry for general solderless wiring is a complete electrical wiring kit manufactured by Aircraft-Marine Products, Inc., Harrisburg, Pa.

The kit comprises a 6-purpose precision installation tool which cuts and strips the wire, indicates stud sizes and crimps terminals to the wire. Also included in the kit is an assortment of 100 amp solderless terminals of the most commonly used types. No soldering is required to make trouble-free electrical connections.

High-Voltage Direct-Current Supply Units

A new line of metal-enclosed, high-voltage d-c power supply units, available in ratings up to 50,000 volts d-c, has recently been placed on the market

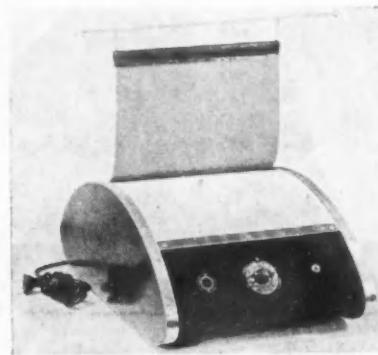


G-E direct current power supply unit

by the General Electric Company, Schenectady, N. Y. These units provide a source of d-c power for applications such as testing of electric equipment, precipitation; induction heating and miscellaneous industrial and electronic applications requiring a high-voltage d-c supply.

Each unit consists of a full-wave kenotron rectifier, a filter to limit voltage ripple to 1 per cent or less, and

Versatile Machine for Reproduction Work



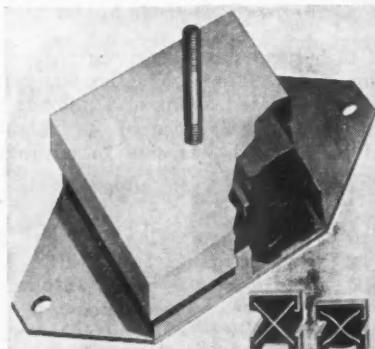
The Hunter Electro-Copyist Machine Model No. 50, made by Hunter Electro-Copyist Co., Syracuse, N. Y., has application where ever reproduction work is required from anything written, typed, printed, drawn or photographed. Its length is 24½ in., height 8½ in. and width 14¾ in. A Rhodes mechanical timer, mounted on the front of the machine, controls the period of exposure.

complete control equipment—all mounted in a steel cabinet. The four kenotron tubes are mounted in sockets integral with the double-conductor, high-voltage terminals on the cover of the single oil-filled tank which contains the combined main and filament transformers. The d-c output voltage can be controlled, from zero to maximum, by means of a motor-operated, dry-type, variable autotransformer. All of the meters, indicating lights and manual controls for the entire equipment are located on a recessed panel in the upper section of the cabinet.

Vibration Mount Withstands Overload

Rexon, a new type of vibration mount, has just been introduced by Hamilton Kent Manufacturing Company, Akron, Ohio. The maker claims that determination of the proper type of Rexon mount and its actual installation requires neither engineering skill nor alteration of equipment. Only two standard types of Rexon mountings are required to isolate all kinds of vibration. Loading is not critical—a tolerance of plus or minus 10 per cent in computing machine weight or weight distribution is permissible.

Rexon utilizes the vibration dampen-



Rexon mount

ing properties of rubber in shear, but with no possibility of overloading the shear elements. This property stems from the use of a special "X" type design of the rubber element which acts in shear at the points of the "X" under normal loading, but in compression when the load exceeds the rated capacity of the mount.

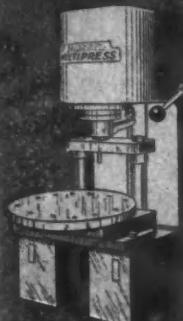
New Cutting Alloy

Boreloy is the name of a new ferrous cutting alloy produced by General Aircraft Equipment, Inc., South Norwalk, Conn. A unique method of centrifugal casting renders possible the incorporation of two potent elements, boron and cobalt, to the basic alloy. Room temperature hardness may reach high values when needed (Rockwell C-70 or better).

Two grades of Boreloy are available. Grade 5 with 12 per cent (Turn to page 85, please)

INDUSTRY'S NEW TOOL OF MULTIPLE USES

A Four-ton giant in midget form!



Showing
Dial-Type Feed

With Motor Driven
Indexing Table



Equipped for
Automatic Pelleting

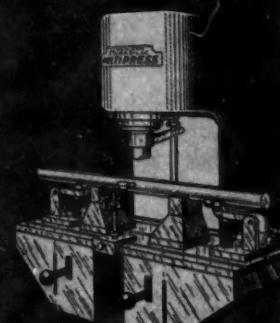


INDUSTRY'S RIGHT HAND

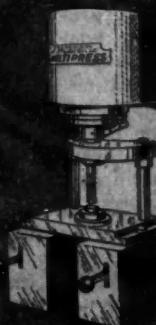
DENISON EQUIPMENT IN APPLIED
HydroOILics

MULTIPRESS is a new kind of machine tool! Compact, streamlined, completely self-contained, this bench-size oil-hydraulic "work horse" packs up to 4 tons of accurately controlled power, and adapts that power to an amazingly wide range of operations. Standard fixtures and accessories extend its applications to almost every type of work calling for pressure—sustained or in repeat strokes . . . in single or automatically repeated cycles . . . synchronized with indexing tables or other feed mechanisms.

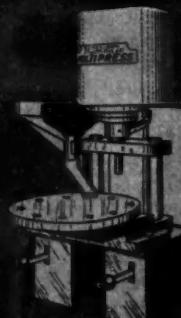
The basic unit alone, without any of its many accessories, delivers downward ram pressures of from 300 to 8000 pounds . . . upward pressures to 5000 pounds . . . strokes of from 1/16 inch to 6 inches . . . ram speeds up to 200 inches per minute downward, or 300 upward. Work table measures 10 1/2 x 16 inches. Opening between ram and work table is 11 inches. Write today for complete details on MULTIPRESS, the NEW tool of Industry's Right Hand.



With Straightening Fixtures



With Broaching Attachment



With Hopper and
Dial-Type Feed

Basic Unit
\$5750

Patents Applied For

With Honing
Fixtures

NEWS OF THE INDUSTRY

Piecemeal Reconversion of No Value to Automotive Industry

Wholesale Release of Suppliers from War Work Necessary Before Passenger Cars Can Be Built

In mid-November, there was a brief flurry of false optimism over the prospects of passenger cars being placed on the list of items which could be cleared for manufacture under WPB's "spot" authorization plan, but it was quickly squelched by that agency as entirely erroneous. J. A. Krug, WPB chairman, said that the subject had been considered, but that it was thrown out as impracticable. This was no surprise to automobile men in Detroit, who know better than anyone else that piecemeal reconversion is of no value to the automobile business and that there will be no real reconversion until there is a wholesale release from war work all down the line of suppliers.

With government agencies branding the war production program critical in respect to many important items now being made in automobile plants, industry leaders know that such a general escape from war work is not in the cards for the immediate future unless Germany folds up unexpectedly, which does not seem likely at this time. In fact, military and government officials are so frankly concerned about the lag in certain critical war weapons that they have been touring the country's production centers to put the finger on and correct bottlenecks and to whip up output in every way possible. Chief trouble spots at the moment are heavy-duty trucks and heavy ammunition.

The truck program has been lame from the very outset. Originally projected for nearly a million units, schedules have been reduced in the face of hopeless prospects of reaching the original goal, until the program at present is aimed at 806,000 trucks this year. At present, however, it looks as though the overall program will wind up the year about 5 per cent behind the revised quota. Year's end deficiencies by categories are estimated to be about as follows: Heavy-heavy 20 to 30 per cent; light-heavy, about 8 per cent; medium, slightly more than 1.5 per cent, and light, less than .05 per cent.

Manpower, both in foundries and in truck assembly plants, appears to be one of the major obstacles holding up

the program. Irving Babcock, head of General Motors Truck, said at a recent meeting in Detroit that his company had lost more than 700 men in a 60-day period because of publicity on cutbacks and a general feeling that the war is nearly over. Foundrymen are of the opinion that their manpower situation is hopeless and that there is very little chance for improvement so long as OPA and WLB refuse to set higher prices on the product and allow higher wages in the industry. Appar-

ently, these agencies have not yet been convinced that the situation is as critical as propounded by WPB and the military.

The heavy ammunition program must be stepped up at least 100 per cent during the next five months because of unprecedented demands, according to WPB. The principal stumbling block in the path of this objective is the lack of machine tools of the particular type needed. Machine tool manufacturers say that their chief difficulty is the shortage of pumps and valves, which can be traced again to the lack of forgings. Actually, what has happened in the shell program is that military needs have zoomed beyond all expectations. A recent report from the front says that troops on the Western Front are shooting up 35 days' planned supply of heavy ammunition in 10 days

(Turn to page 52, please)

NLRB Decision in Chrysler-UAW-CIO Case Gives Clue to Rulings in Similar Appeals

Although given virtually no publicity, a significant decision refusing to review a ruling by the Detroit Regional War Labor Board was handed down by the National War Labor Board, Oct. 20, in Washington. In its original ruling, the Detroit board last June denied demands of the UAW-CIO upon the Chrysler Corporation for concessions encompassing broad social and economic gains. At that time it held "both the guaranteed work week and unemployment insurance look forward to conditions which will prevail in labor when the war ends and, WLB being a war agency, cannot with propriety determine such conditions after the war."

The specific demands which were denied at that time and which the NLRB refused to review were:

1. That the corporation be required to establish a postwar security fund.
2. That the corporation be required to guarantee 40 hours of work per week.
3. That the corporation be required to pay the insurance premiums and group hospitalization of all employees having seniority.
4. That there shall be mutual agreement with management on rates of pay for new work before operations begin.
5. That employees, when late, shall be docked only for the time actually lost. (However, late employees shall not be required to work until the end of the nearest 15-minute interval.)
6. That existing wage differentials

between the Detroit plants of the corporation and its plants elsewhere in the country be eliminated.

The NLRB's decision is considered important because it gives a clue to what may be expected in the case of similar appeals now pending, notably that involving General Motors Corp., against which the same or similar demands have been made.

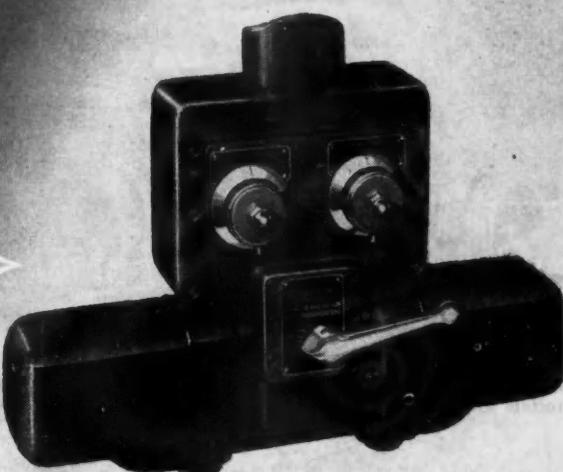
New Nose Design



The Curtiss Commando has been given a hinged nose cone providing access to the back of the instrument panel in the pilot's compartment. The new nose also has a recessed windshield (Aeme Photo)

**SMOOTH
and CONSTANT
FEED RATE**

**regardless of fluctuations
in work resistance or
hydraulic operating pressure**



**Double Solenoid Type
Push-button Operation**

VICKERS "Traverse and Feed Cycle" CONTROL PANELS

These panels provide self-contained, compact control units for automatic machine applications where the cycle is a combination of rapid advance, one or two feeds, and rapid return motions. The two feed rates are infinitely variable within their ranges, and adjustments can be made during feed. Applications include drilling, reaming, boring, turning, milling and swaging machinery.

The hydraulic circuit in the panel employs the well-known Vickers Flow Control Valve in a "metering-out" circuit which means a smooth and constantly maintained feed rate for any given adjustment regardless of fluctuations in cutting tool resistance or changes in hydraulic operating pressure.

Simplicity is evident from the fact that there are only two

working parts that move. Many standard modifications are available; feeds can be in either direction or both directions; operation is by single or double solenoids integral with panel, separate solenoids or pilot pressure. Practically any cycle sequence can be obtained. See Bulletin 41-10 for complete information.

Vickers Application Engineers will gladly discuss with you how "hydraulics" can be used to your advantage.

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**Representative of More than 5,000 Standardized Vickers Units
for Every Hydraulic Power and Control Function**



CONSTANT DELIVERY PUMPS



FLUID MOTORS



DIRECTIONAL CONTROLS



VOLUME CONTROLS



PRESSURE CONTROLS

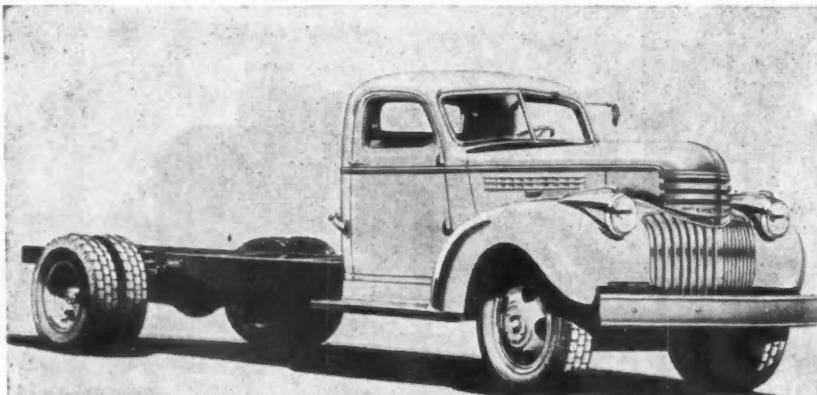


CONTROL ASSEMBLIES



VARIABLE DELIVERY PUMPS

Chevrolet 1945 Truck Chassis



The line covers two wheelbase sizes: 134½ in. and 160 in. in heavy duty and cab models. The engine displacement in each is 235.5 cu. in. The two models are alike except for differences incidental to the different wheelbases.

All-Direction, Static-Free Radio Range

Static-free very high frequency radio ranges, which will register the bearing of an airplane on an instrument in the cockpit, have been developed by the Technical Development Division of the Federal Airways Service of the Civil Aeronautics Administration, and are now going through final testing. Demonstrations are being given to airline pilots and officials at the CAA Experimental Station in Indianapolis, and further refinement is in progress.

The new range will send course signals in all directions from the station, in comparison with the present low frequency range which sends out only four. The new range is also equipped for voice, as is the old, but has the advantage of being practically free of static which currently makes reception of signals unintelligible under certain conditions.

In actual flight, the pilot can select any desired compass course by setting a pointer on a 360 degree compass type dial. So long as he maintains the course, the vertical pointer on another dial—usually the standard cross-pointer instrument used for instrument landings—remains centered. Deviations are indicated to right and left up to 10 degrees maximum on the dial.

Should the pilot get far off course, despite continual instrument indication of his flight path, he can determine immediately his bearing to any station within receiving range by centering the vertical pointer and reading the bearing on the scale of degrees. He can also take bearings on two or more stations and pinpoint his position by cross-bearing methods.

The new VHF ranges will have a distance range of 50 miles at 1,000 feet, increasing to 100 miles at 10,000 feet. Results obtained in the development of the range have been so prom-

ising that the CAA has designed the VHF ranges now being installed so that they can be converted to the new type easily and inexpensively.

This type of air navigation facility makes it possible for the private pilot

Tentative Orders Assist Steel Mills in Estimating Extent of Future Demand

Steel Output, However, Continues to Be Made Up Almost Entirely of Material for War Contractors

By W. C. Hirsch

Steel demand continues to be made up almost entirely of business coming in from war contractors. There is a profusion of so-called tentative orders which will not become binding commitments until after the defeat of Germany. Into this category fall what for the present are considered nothing more than estimates by automobile manufacturers and parts makers of how much of the various descriptions of steel they will be able to take once they get the green light and in the weeks following. Steel producers thus get a picture of the extent to which the capacity of their mill departments is likely to be absorbed in the period immediately following the blackout of civilian business. Tentative as this business is, the preliminary estimates by consumers of their requirements are considered decidedly helpful by steel sellers. Nor is there any doubt that automobile manufacturers and steel producers understand one another's views regarding the pace of shipments during the initial period of resumption. For the present, however, the expediting of war material orders continues to be the chief concern of steel mills. So, for instance, much of the recent activity in the sheet market was made up of orders for 14 and 16 gauge,

of a small airplane, with an inexpensive, light-weight radio receiver to navigate by radio anywhere in the country without extensive training in its use.

Timken to Open Canadian Plant

St. Thomas, Ontario, will be the site of a new bearing and rock bit plant to be operated by the Timken Roller Bearing Company, Limited, Canadian subsidiary of the Timken Roller Bearing Company of Canton, Ohio.

The Timken Roller Bearing Company, Limited, has purchased from the city of St. Thomas approximately seventy-five acres of ground on the east side of the city in Talbot Street, an area served by the Canadian National Canadian Pacific, Pere Marquette, Michigan Central, Wabash, and the London and Port Stanley Railroads.

Design of the plant buildings will be started immediately and operations, requiring an estimated three hundred employees, will begin as soon as possible.

hot rolled, single-pickle sheets for ammunition boxes. Both metal producers and consumers have time and again demonstrated in this war that they place the Nation's welfare and safety above all other considerations, and they
(Turn to page 178, please)

CALENDAR

Conventions and Meetings

| | |
|---|----------------|
| SAE Natl. Air Cargo Mtg., Chicago | Dec. 4-6 |
| Natl. Aviation Trades Assoc., St. Louis | Dec. 6-7-8 |
| SAE Annual Meeting, Detroit | Jan. 8-12 |
| Natl. Automobile Dealer Annual Convention, Chicago | Jan. 29-31 |
| Automotive Electric Assoc., Chicago | Feb. 5-12 |
| Motor & Equipment Wholesalers Assoc., Annual Meeting, Chicago | Feb. 26-28 |
| Amer. Soc. for Testing Materials, Pittsburgh | Feb. 28 |
| American Foundrymen's Assoc., Detroit | April 30-May 4 |
| Pan - American Aircraft Exposition, Dallas, Texas | May 20-27 |
| American Society for Testing Materials, Annual Meeting, Buffalo | June 18-22 |

One of these Needle Bearings May Solve a Design Problem for You...



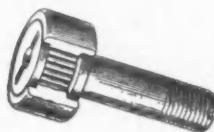
TYPE DC is suitable for applications where size, weight and cost must be held to a minimum.



TYPE AT is designed for aircraft applications in conjunction with standard AN bolts.



TYPE FDT is used for heavy loads in applications where deflections are encountered.



TYPE RC is designed for cam follower service and rolling loads, where outer race is not supported by housing.



TYPE NCS is particularly suitable for severe load applications and rugged service conditions.



TYPE PN (Single Row) is used primarily for aircraft pulleys carrying secondary control cables.



TYPE PN (Double Row) meets all aircraft pulley requirements for primary control applications.



TYPE LN Needle Rollers are adaptable where it is impractical to use an assembled unit type Needle Bearing.

It may not have occurred to you that there are so many different types of Needle Bearings—or that the completeness of the line of these modern, anti-friction bearings makes them adaptable to many design requirements.

Pictured above are eight different types—all different in design yet employing the same basic design principle of a full complement of small diameter needle rollers. Each is engineered for a particular task—or combination of design requirements. Individually each offers the same characteristic advantages of compact design, small size, light weight, high capacity, efficient lubrication and low cost.

The result is that in almost any application where Torrington Needle Bearings are employed, the design prob-

lem is simplified; operating efficiency and service life are increased; manufacturing costs are reduced, and sales features are added.

Investigate for yourself how these advantages can be of assistance in your product planning. The Torrington Needle Bearing Catalog 30-A gives

complete information, and our engineering staff is ready to help you with any specific design requirement.

THE TORRINGTON COMPANY

Established 1866 • Torrington, Conn. • South Bend 21, Ind.
"Makers of Needle Bearings and Needle Bearing Rollers"

New York Boston Philadelphia
Detroit Cleveland Seattle
San Francisco Chicago Los Angeles
Toronto London, England



TORRINGTON NEEDLE BEARINGS

PUBLICATIONS

A 12-page digest entitled **Production Cleaning of Die Castings**, has been released by Oakite Products, Inc. It describes various cleaning techniques and materials for the surface preparation of aluminum, zinc, magnesium, brass, bronze, copper, lead or tin base die castings prior to the application of organic, chemical or electro-plated finishes.*

The Amalie Div., L. Sonneborn Sons, Inc., has published a 12-page illustrated booklet describing its complete line of lubricants for every important lubrication point from chassis to wheel bearing, steering gear, universal joints, water-pump, springs, hypoid gears and other vital parts. The booklet is divided into three sections, chassis, transmission and differential and general, and contains a quick-finding index enabling the reader to choose the right lubricant for every purpose.*

Progressive Welder Co. has issued a new booklet, **Resistance Welding at Work** (Bulletin WP-44). It is designed, primarily, as a guide to the wide variety of uses to which resistance welding adapts itself, whether single spot or multiple spot, seam or flash, etc. The material has been arranged under five general headings, portable gunwelding (for work assembled in fixtures); stationary spot welding, single and multiple; seam welding, either in machines or in fixtures.*

Air Reduction has issued a new bulletin on acetylene generators. It features the new Aircos Type "P" Portable Generator,

describes and illustrates the company's complete line of generators, including portable models in 15, 30 and 50-lb sizes.*

Cutting Fluids for Better Machining is the title of a new handbook by D. A. Stuart Oil Co. It contains extensive data on steels, machinability, hardness, tools, speeds and feeds and allied subjects, as well as information on the selection and use of cutting and grinding fluids.*

Bauer & Black has issued a catalog of **Industrial Adhesive Tapes**. Each type of tape manufactured is clearly identified by a number, special properties and applications are listed on separate pages for each tape and a comparative price table occupies two pages in the center of the catalog. A comparison chart is also included which lists each tape and compares its special properties, specifications and applications to other Bauer & Black tapes.*

Plastics—On the Surface, is the title of a new booklet by Roxalin Flexible Finishes, Inc. The book is designed to give information on this important utilization of plastics and to help realize the far-reaching possibilities of such materials where particular products and problems are concerned.*

A new catalog describing the complete line of **Superior Fluxes** has been announced by Superior Flux Co. Included in the line are 20 fluxes for welding, brazing, silver soldering, soft soldering and low temperature alloy welding of ferrous and non-ferrous metals and alloys. For each flux listed there is a detailed statement of its characteristics and a full schedule of list prices.*

Four new publications illustrating and describing the **3-M Method of grinding and**

finishing have been released by Minnesota Mining and Mfg. Co. **Step Up Production with 3-M Method of Grinding and Finishing** is designed to provide purchasing agents, work managers, production managers, chief engineers, etc., with up-to-the-minute facts and information on this grinding and finishing method. It is well illustrated and contains complete information on this process. Three small booklets in the series deal individually with the 3-M Method as applied to the grinding and finishing of small parts and tools, heavy-duty grinding and finishing of flat or curved surfaces and the 3-M Method employing a semi-portable unit for grinding and conditioning raw metal stock for cutting down large welded areas.*

Black Drill Co. has issued a new booklet on **Hardsteel Tools**. Described is the Hardsteel method of drilling, grinding, etc., tables of drill sizes, hardness conversion, use of cutting fluids, etc.*

Two new booklets have been issued by Engineers Specialties Div., Universal Engraving and Colorplate Co., Inc. **Detail Engineers' Glass** describes the two types of glass, translucent and scribing, and illustrates and describes the new Grid Comparator Charts. The second booklet gives specifications and prices of products manufactured by Engineers Specialties Div.*

Chicago Metal Hose Corp. has issued a new pamphlet, **Flexible Metal Hose for Every Industrial Use**, showing the basic types of flexible metal hose available and some of their specifications.*

A new folder describing **Pennsalt Cleaner EC-10** has been issued by Pennsylvania Salt Co. It explains the use of this metal cleaner in both dip cleaning and spray washing methods of cleaning. Pictures of interesting tests demonstrating the cleaner are included in the pamphlet.*

Aircraft Tools, Inc., has published a new reference manual, containing photographs, blueprint drawings and full construction details of small hand tools for aircraft production and maintenance.*

* Obtainable by subscribers within the United States through Editorial Dept., AUTOMOTIVE and AVIATION INDUSTRIES. In making requests for any of these publications, be sure to give date of the issue in which the announcement appeared, your name and address, company connection and title.

Bendix Plants in France Not Seriously Injured During German Occupation

By W. F. Bradley, European Correspondent

Bendix interests in France have suffered comparatively little during the German occupation, says Henri Perrot, head of that organization. Being very largely an American concern, the French Bendix works was sequestered when the Germans came in, and Herr Kronfeld, of the Teves Brake Company of Frankfort was put in charge. This was in accordance with the German policy of putting experts from rival concerns in charge of French businesses, thus enabling them to get inside knowledge of their rivals' doings. Kronfeld, who managed more than a dozen other businesses in France, preferred to go into a French prison rather than return to the Fatherland. He gave himself up when American troops entered Paris.

During the occupation Bendix paid no dividends and thus prevented money from getting into German hands. They worked indirectly for the German forces by supplying equipment for such firms as Citroen, Peugeot and Renault. Towards the end a direct order was placed for brake equipment for German trucks, but they never got into production on this. No part of the plant was removed, but the machines suffered somewhat by reason of the use of poor quality lubricating oil. At the present time there is little output, for the French automobile factories are not in operation.

Air Equipment, an organization in

which Bendix had holdings, was completely wiped out when the American aviation made its attacks on the S.K.F. ball bearing works and the Hispano-Suiza factories, near Paris.

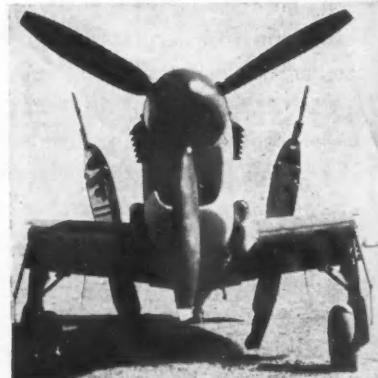
Clark Heads Export Committee of AMA

Appointment of John Clark of Reo Motors, Inc., as chairman of the Automobile Manufacturers Association's Export Committee was announced by Alvan Macauley, president. S. I. Carlson of Nash will serve as vice chairman of the committee.

Mr. Clark, who succeeds Allen Germain, Hudson Motor Co. as committee chairman, has been export manager of Reo since 1939. Upon entering the export field in 1935, Mr. Clark travelled extensively among Latin American countries. Before that time, he served in the Reo sales, service and production divisions.

Mr. Carlson, export sales manager for Nash Motors, has had wide overseas experience for automotive companies in Europe, North Africa and the near East. Prior to joining the Nash-Kelvinator Corporation, he was affiliated with Chrysler Corporation, Nordyke & Mormon Company, Dodge and Packard in various capacities.

British Firefly

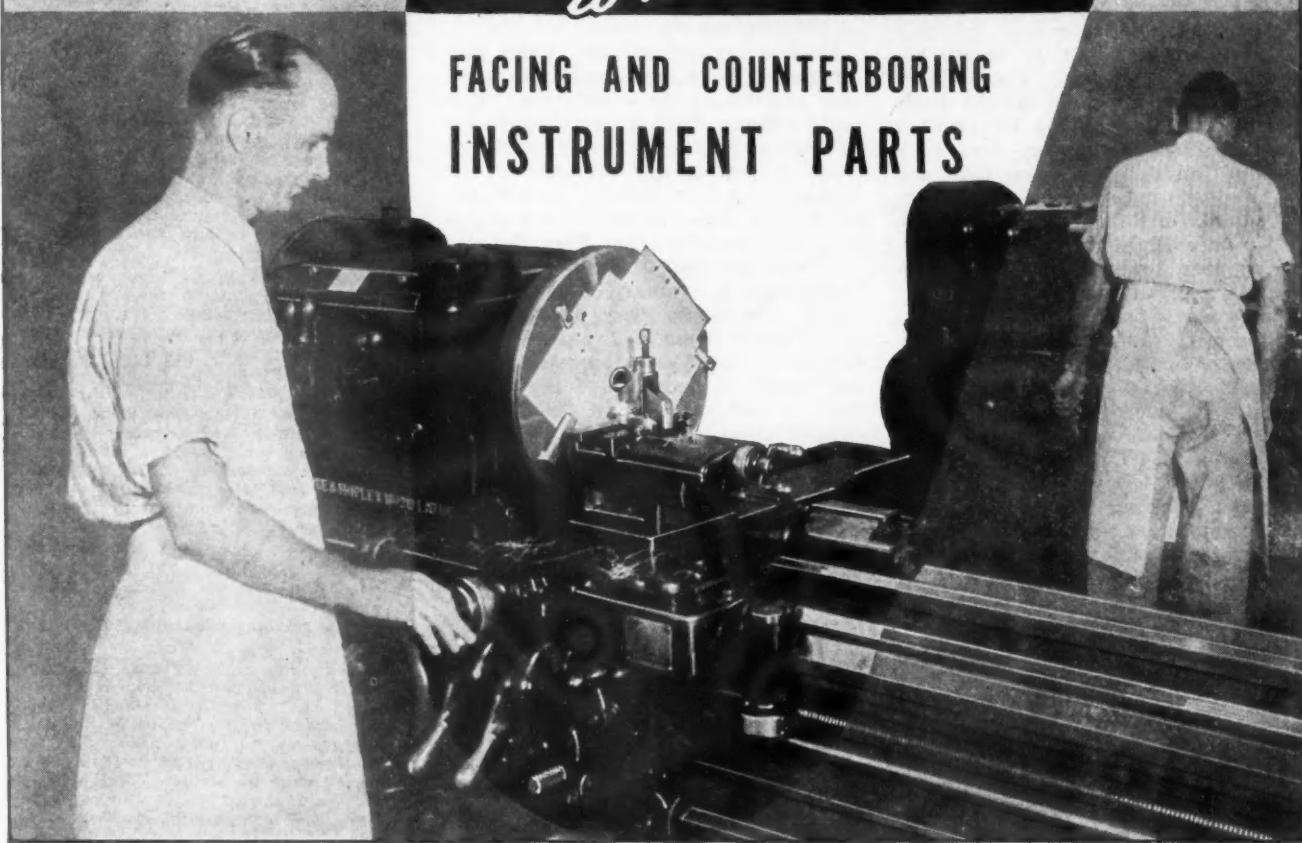


Pictured here with wings folded for carrier stowage is the British Navy's new fighter-reconnaissance plane the Firefly which will soon be operating from British carriers in the Pacific. The Firefly has proved itself in attack on the German battleship Tirpitz in Norway recently. It is a low-winged monoplane armed with four 20-mm cannon and equipped with a camera for vertical aerial photography. It carries a crew of two and has a wingspread of 44 ft. 6 in. and is 37 ft. long. (International Photo)

LODGE & SHIPLEY
LATHES at work

... boring a 1.250" hole
to .0003" tolerance

FACING AND COUNTERBORING
INSTRUMENT PARTS



at WRIGHT'S AUTOMATIC MACHINERY COMPANY . . .

For more than 50 years, Wright's Automatic at Durham, N. C., has pioneered in the development and manufacture of automatic packaging machinery. To manufacture these marvels of mass production packaging, the lathes selected were required to possess unusual versatility, yet maintain accuracy to very close tolerances.

Lodge and Shipley Engineers recommended 16"/20" Selective Head Lathes with Roller Bearing Spindle Mounting. With these Lathes, Wright Automatic performs a wider

range of work than is ordinarily possible, with greater selection of speeds, feeds and threads available.

Today, Wright's are entirely devoted to producing naval gun-fire control instruments which require close tolerance boring and turning. Here, too, Lodge and Shipley 16"/20" Lathes perform with equal facility.

To turn better, more profitable work, call on L & S Engineers. For details on the 16"/20" Lathe, write on your company letterhead.

THE **L**ODGE & **S**HIPLEY MACHINE TOOL CO.

CINCINNATI 25, OHIO, U.S.A.

ENGINE - TOOL ROOM - AUTOMATIC - OIL COUNTRY LATHES

December 1, 1944

When writing to advertisers please mention AUTOMOTIVE and AVIATION INDUSTRIES

Piecemeal Reconversion of No Value to Automotive Industry

(Continued from page 46)

and there are no reserves in this country.

Production of aircraft in October declined to 7429 units, a drop of about 2 per cent under September, bringing the total for the first 10 months of 1944 to 82,924 planes. The October output on an airframe weight basis also was down, dropping off about 4 per cent from September. Deliveries were not up to schedule on B-29 and B-32 super-bombers and on heavy transports. On B-24 and B-17 bombers, carrier-based fighters, most transports and trainers, however, output for October was generally satisfactory.

Buick Motor Div. of General Motors is increasing production of Pratt & Whitney aircraft engines with two new types of motors having greater horsepower and much improved performance. One of the new engines will be used in the B-24 Liberator bomber and the other in the Douglas C-54 military transport. Tooling for production of the new type engines has been carried out without interrupting produc-

tion on current type engines. To date, Buick has turned out more than 60,000 aircraft engines in the past 32 months, with output having reached in excess of 3200 engines per month.

Despite recent cutbacks, daily production of B-24 bombers has dropped only slightly at the Ford Willow Run bomber plant. The big plant, which for 14 months was consistently ahead of schedule, now is approximately on the Army schedule, despite the drop in the work week from six days to five beginning in September. The Ford Co. also has revealed that the jet propulsion engine which it is building for the Army Air Force was developed in three weeks from a five-page Allied Command report describing the apparent construction details of unexploded Nazi robot engines, a photograph clipped from a magazine, and badly mutilated engine parts from an exploded robot. Other manufacturers working on the project are: Republic Aviation Corp., which is making the airframes and assemblies; Jack and Heintz, Inc., which is producing the directional control equipment and compressed air bottles; Monsanto Chemical Co. which is supplying the launching rockets; Bell Aircraft Corp. and Sperry Gyroscope Co. In the statement of Maj.-Gen. B. E. Meyers, deputy chief of ATSC, there is a hint that the new weapon will have greater directional accuracy than its German prototype. He stated that the U. S.-built robot "is not a copying job, because we have no interest in a weapon that destroys at random."

The official publication of the Army Air Forces reports introduction of a new small land vehicle designed for use in areas where larger vehicles cannot go. The vehicle, called the "Jungle Jeep," has a flat platform with the motor underneath and is equipped with a motorcycle-type hand throttle and hand-operated brake lever mounted on a swivel tiller bar that replaces the steering wheel. The operator can lead, follow or ride the vehicle over rough terrain. Capacity is 800 lb.

Studebaker Corp. has entered into an agreement with the Chicago Ordnance district for predetermining termination claims in connection with its contract to build the "Weasel," amphibious cargo carrier. A supplement to the original contract, the agreement covers: 1. Determination of which government property will be scrapped and which retained by Studebaker, together with the price to be paid; 2. procedure in estimating factory overhead costs; 3. administrative expense overhead; 4. the allowable percentage of profit; 5. allowable items of post-termination expense, and 6. per cent of payment that will be allowed when the termination claim is made.



AWARDS

Names of winners of Army-Navy "E" awards in or allied with the automotive and aviation industries announced since the Nov. 15 issue of *Automotive and Aviation Industries* went to press:

BUCYRUS-ERIE CO., Evansville, Ind.
GEMLOID CORPORATION, Elmhurst, Long Island, N. Y.
HILO VARNISH CO., Brooklyn, N. Y.
LAMSON CORPORATION, Syracuse, N. Y.
A. LESCHEN AND SONS ROPE CO., St. Louis, Mo.
THE POLSON RUBBER CO., Garrettsville, Ohio.
PRECISION MANUFACTURING CO., Detroit, Mich.
J. K. SMIT & SONS, INC., New York, N. Y.
STANDARD FOUNDRY CO., Racine, Wis.
THE WEATHERHEAD CO., Columbia Products Div., Columbia City, Ind.
WEST & DODGE THREAD GAUGE CO., INC., South Boston, Mass.
WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., Lima, Ohio Plant, Lima, Ohio.
L. A. YOUNG SPRING & WIRE CORP., Chicago Div., Chicago, Ill.

★ "E" Star Awards ★

for continuous meritorious services on the production front have been awarded to the following firms:

AEROPRODUCTS DIVISION OF GENERAL MOTORS CORP., Dayton, Ohio.
ALUMINUM INDUSTRIES, Cincinnati, Ohio.
KOPPERS COMPANY, American Hammered Piston Ring Div., Baltimore, Md.
WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., Sharon Works, Sharon, Pa.

Business in Brief

Written by the Guaranty Trust Co., New York, Exclusively for AUTOMOTIVE AND AVIATION INDUSTRIES

Comparatively stable high levels of business activity are currently indicated. The *New York Times* index for the week ended November 4 stands at 140.1, as against 137.3 for the preceding week and 136.6 a year ago.

Department store sales, as reported by the Federal Reserve Board, increased from 207 to 214 per cent of the 1935-39 average during the week ended Nov. 4. The indicated total is 6 per cent above that for the corresponding period last year, as against a rise of 11 per cent reported a week earlier. The aggregate figure for 1944 to date is 9 per cent above the comparable sum last year.

Railway freight loadings during the week ended Nov. 2 totaled 893,333 cars, 2.5 per cent below the figure for the preceding week but 18.4 per cent above the temporarily reduced number reported a year ago.

Electric power production increased moderately during the week ended Nov. 11 but remained below the corresponding level in 1943, showing a year-to-year decline of 1.9 per cent, as compared with a similar reduction of 1.3 per cent recorded in the preceding week.

Crude oil production in the same period averaged 4,727,400 barrels daily, 7500 barrels above the figure for the week before and 290,950 barrels above the comparable output last year.

Production of bituminous coal during the week ended Nov. 4 is estimated at 11,950,000 net tons, 1.6 per cent less than the output in the preceding week but much above that for the corresponding period in 1943, when miners were on strike. Total production so far in 1944 is 7.5 per cent above the comparable quantity last year.

Engineering construction contracts awarded during the week ended Nov. 16, according to *Engineering News-Record*, totaled \$29,400,000, as against \$8,805,000 in the preceding week, which included election day, and \$68,931,000 a year ago. The total for the year to date is 45 per cent below the comparable sum in 1943, with a decline of 26 per cent in private construction accompanied by a drop of 48 per cent in public awards.

The Irving Fisher index of wholesale commodity prices for the week ended Nov. 10 stands at an all-time peak of 113.88 per cent of the 1926 average, as against 113.80 a week earlier and 111.10 a year ago.

Member bank reserve balances increased \$76,000,000 during the week ended Nov. 8, with excess reserves remaining at an estimated total of \$900,000,000. Aggregate loans and investments of reporting members declined \$344,000,000 in the same period, although the total of commercial, industrial and agricultural loans increased \$40,000,000.

L. G. Peed Retires

After serving the industry for thirty-five years—fifteen with De Soto—L. C. Peed, vice president in charge of sales of the De Soto Division, Chrysler Corporation, is retiring from the automobile business.

The CONE AUTOMATIC MACHINE COMPANY
sees many
GOOD THINGS AHEAD



It is reported that

The soybean is now the third largest cash grain crop in the United States.

get ready with CONE for tomorrow

Aluminum can now be chemically bonded to steel so that the two become a completely integrated unit. This process has already contributed greatly to improvement in the horsepower per pound ratio of certain of our aircraft engines.

get ready with CONE for tomorrow

A 200 page book may now be printed on both sides of a 6 x 9 inch sheet and enlarged for reading by the use of a new machine. This would bring the cost of books to about five cents per volume. It is estimated that a full size encyclopedia, printed by this method, would cost about three dollars.

get ready with CONE for tomorrow

One authority states that oil can be produced from American shale in commercial quantities and at a competitive price.

get ready with CONE for tomorrow

Zein, the new shellac substitute derived from corn, is being used in shoe soles and heels, cements, rain coats, mats, gaskets, and rubber stamps. Packaging films, textile fibers, and bottle caps may be expected later.

get ready with CONE for tomorrow

Most radical of all the new power plants is one in which the fuel is burned in gas mantles and the radiant energy produced is converted into electricity by photo-electric cells.

get ready with CONE for tomorrow

Pure iron can now be deposited on non-metallic substances. By this method a surface of iron may be put on a base of rubber, wood, or plastic.

Aerial photography can show whether the soil of a particular area is gravel, sand, silt, or clay.

get ready with CONE for tomorrow

A new lacquer can be baked on to metal surfaces and removed by heating above 212° F.

get ready with CONE for tomorrow

An experimental Diesel engine weighs only eleven ounces per horsepower and can operate on either Diesel oil or gasoline.

get ready with CONE for tomorrow

A Canadian manufacturer of railroad equipment has designed a flatcar to be used as a landing place for helicopters.

get ready with CONE for tomorrow

The "axonograph" is a device that photographically produces an axonometric drawing directly from a blueprint.

Some of the new paper-resin laminates may now be formed as easily as a cook lines a plate with pie crust, and require pressures as low as 50 lbs. per square inch.

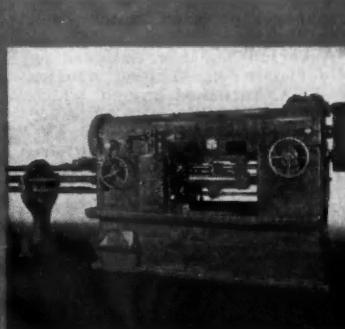
get ready with CONE for tomorrow

Glass fabric impregnated with synthetic resin is a new material with extraordinary properties. Tensile strength may be more than 80,000 lbs. per square inch.

get ready with CONE for tomorrow

Five states have pooled their electrical generating capacity with results equalling the addition of 135,000 horsepower. This practice is expected to spread.

*This machine cuts
its own weight
in metal in
four days*



3 1/2" 6-Spindle Conomatic

To produce the part shown, 6 pounds of chips — over a sixth of a ton of metal per hour — were removed from WD1314 bar stock.



CONE

AUTOMATIC MACHINE CO., INC. ★ WINDSOR, VERMONT, U.S.A.

12

A-26, the Latest Attack Bomber



The A-26 carries a flexible selection of guns, cannons and bombs making it adaptable to any combat situation. It is powered with twin 2000 hp. R-2800 series engines. Aerodynamically it is exceptionally clean employing the low-drag (Laminar Flow) airfoil wing section. Accessibility to all parts has been stressed in the design.

PERSONALS

L. F. Carlson has been appointed director of public relations for Oldsmobile Div. of General Motors Corp. Also announced is the appointment of P. J. Burns as manager of plant promotion.

John Clark, export manager of Reo Motors, Inc., has been named new chairman of the Automobile Manufacturers Association's export committee. S. I. Carlson, export sales manager of Nash Motors, will serve as vice-chairman.

Hugh F. Anderson has been assigned by Cadillac Motor Div. of General Motors Corp. to head its Cincinnati branch, which will be reopened soon. The Denver office also will be re-established with R. G. Tiffany in charge. Fred H. Murray will succeed Tiffany as district manager at Dallas, Tex. S. H. Milner and T. R. Fenley have been added to the staff of J. A. Browne, head of Business Management.

Emerson Planck, assistant manager at the Washington, D. C., branch since May, 1941, has been promoted by Ford Motor Co. to manager of the Richmond, Va., branch. Also announced by Ford is the promotion of Robert J. Burke from assistant branch manager to branch manager at the Atlanta branch.

Hudson Motor Car Co. had named W. E. Young manager of the Pacific division with headquarters at Los Angeles to succeed Howard P. Grove, who has been appointed manager of a new Northeast division with headquarters in New York City. New zone managers are Clifford C. Jones, at Los Angeles, and Boxley Cole, at Denver. Fred Blaich is assistant zone manager at Los Angeles.

R. C. Somerville, formerly staff executive of the Plymouth Div. of Chrysler Corp., has been appointed assistant general sales manager.

William F. B. Henderson, formerly of Briggs Manufacturing Co., has joined the Clearing Machine Corp. as vice-president and general manager.

A. C. Reppenhagen, former general manager of Experimental Tool and Die Co., has been named secretary of Mid-West Abrasive Co.

E. J. Craig has been appointed regional manager in New Orleans for Chrysler Div. of Chrysler Corp. Claude B. Nichols will head the El Paso, Tex., region. New district managers appointed are E. J. Wilson, Syracuse; Arthur J. Wilson, Dallas, and Fred H. MacIntire, Philadelphia.

O. F. Lehman, safety engineer at Chrysler Corporation, has been elected chairman of

the automotive and machine shop section of the National Safety Council.

Wilbur T. May has been appointed by Dodge Div. of Chrysler Corp. to be manager of its New York region, succeeding (Turn to page 174, please)

Dodge Building Trucks for China

Dodge Division of Chrysler Corp. has started shipment to China of several thousand new design trucks built especially for the Chinese military. The trucks combine many features of U. S. Army combat vehicles with special characteristics of particular value in the Chinese theater. Front end construction is rugged, with military type sheet metal fenders, hood, brush guard, and radiator shell. The grillwork is eliminated and all trucks are equipped with 12-foot stake bodies, complete with bows and tarpaulins. Although designed primarily for hauling munitions and supplies, the trucks may be used for hauling troops and evacuating civilians.

About 150 freight car loads of spare parts also will be shipped with the trucks. The parts are packaged, pro-

tected and identified in the same manner as parts for U. S. forces overseas. A 300-page instruction manual, written in Chinese, and a complete list of parts, in both Chinese and English, accompany each truck.

1944 Monthly Production of Trucks and Truck Tractors*

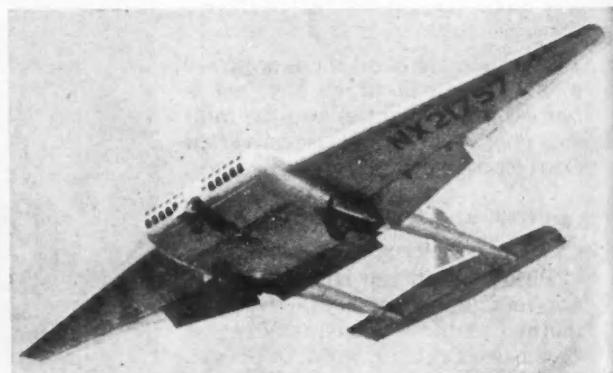
| 1944 | LIGHT Under 9,000 Lbs. GVW | | |
|------------------------------------|-------------------------------|----------|---------|
| | Civilian | Military | Total |
| January | 21,478 | 21,479 | |
| February | 21,095 | 21,095 | |
| March | 21,081 | 21,081 | |
| April | 19,481 | 19,481 | |
| May | 19,338 | 19,338 | |
| June | 20,830 | 20,830 | |
| July | 20,269 | 20,269 | |
| August | 23,441 | 23,441 | |
| September | 21,367p | 21,367p | |
| Total—9 months... | 188,381 | 188,381 | |
| MEDIUM 9,000 to 16,000 Lbs. GVW | | | |
| Civilian | Military | Total | |
| January | 1,985 | 12,806 | 14,791 |
| February | 1,798 | 9,940 | 11,738 |
| March | 3,317 | 8,303 | 11,620 |
| April | 6,245 | 6,649 | 12,894 |
| May | 7,310 | 7,007 | 14,317 |
| June | 9,319 | 6,625 | 15,944 |
| July | 8,582 | 6,031 | 14,613 |
| August | 10,249p | 5,748p | 15,994p |
| September | 10,032p | 6,300p | 16,332p |
| Total—9 months... | 58,636 | 69,407 | 128,243 |
| HEAVY 16,000 Lbs. GVW and Over | | | |
| Civilian | Military | Total | |
| January | 543 | 21,783 | 22,326 |
| February | 968 | 21,870 | 22,838 |
| March | 1,311 | 22,347 | 23,658 |
| April | 1,908 | 21,438 | 23,344 |
| May | 1,988 | 21,277 | 23,265 |
| June | 2,607 | 21,805 | 24,412 |
| July | 2,661 | 23,987 | 26,656 |
| August | 2,263p | 26,847p | 29,110p |
| September | 2,069p | 25,098p | 27,167p |
| Total—9 months... | 16,316 | 206,462 | 222,778 |
| TOTAL—ALL WEIGHTS | | | |
| Civilian | Military | Total | |
| January | 2,528 | 56,068 | 58,596 |
| February | 2,766 | 52,905 | 55,671 |
| March | 4,628 | 51,731 | 56,359 |
| April | 8,151 | 47,568 | 55,719 |
| May | 9,298 | 47,622 | 56,920 |
| June | 11,926 | 49,260 | 61,186 |
| July | 11,243 | 50,297 | 61,540 |
| August | 12,511p | 56,034p | 68,545p |
| September | 12,101p | 52,765p | 64,866p |
| Total—9 months... | 75,152 | 464,250 | 539,402 |

r—Revised
p—Preliminary

*Automotive Division—W.P.B.

U. S. Army's Newest Glider

Designed for carrying large numbers of men for invasion and combat operations, this new glider is the result of long and extensive study by Army Air Force technical experts and engineers who sought to develop a motorless craft with the utmost of perfection in tactical use. (International Photo)



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VW
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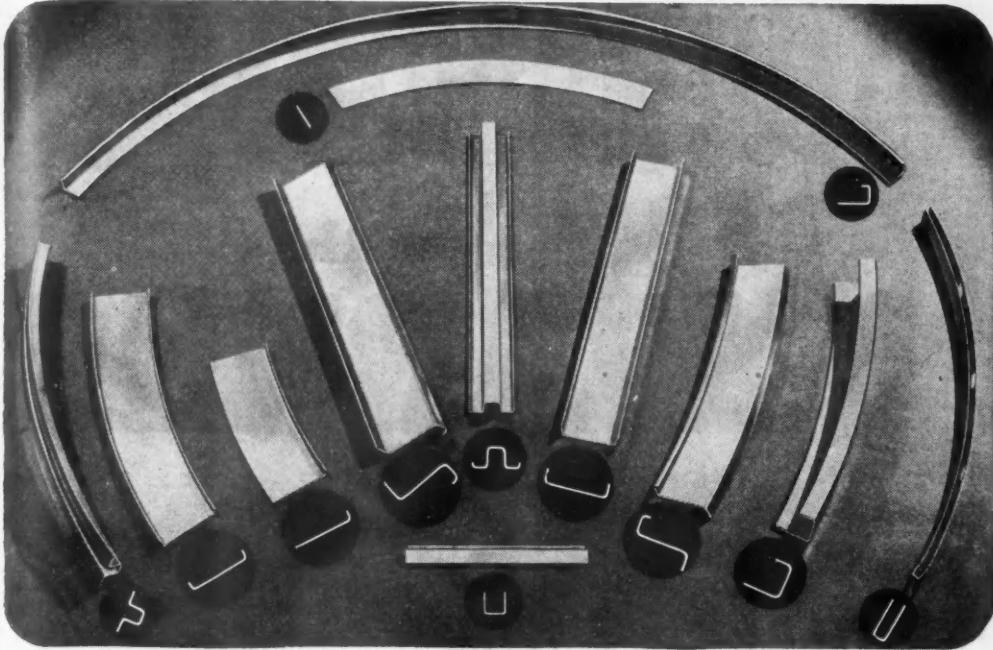
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Total

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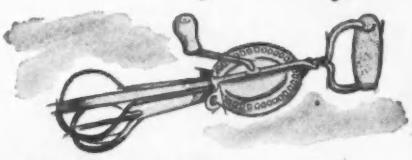
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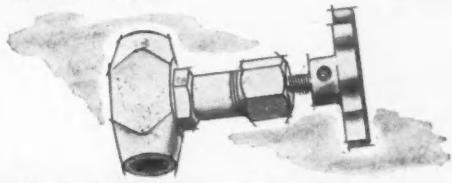
Design Flexibility

These shapes illustrate what you can do with easy-to-fabricate Carpenter Stainless Strip. Lighter gauges and sharper radii are possible with this versatile metal. The life of the product you are designing now can be lengthened, its sales appeal enhanced by making it from bright, uniform Carpenter Stainless Steels.

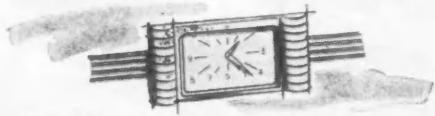
You get these NEW DESIGN POSSIBILITIES with Carpenter Stainless Steel



LOW UNIT COST To gain sales appeal yet keep price competitive, kitchen implements, like the egg beater shown above, gain distinct advantages when made from Carpenter Stainless Steel.



LONG LIFE Valves made from Carpenter Stainless provide resistance to corrosion from a wide range of chemicals and withstand heat, pressure and wear.



EYE APPEAL Unusual eye-catching designs captured in sparkling Stainless! It's easy when you specify Carpenter! For this Stainless trim a light gauge was used without sacrifice of strength and rigidity.

That gleam in your designer's eye probably means one thing: you're planning to launch some exciting new or redesigned product in the postwar market.

There are three ways you can benefit by working with Carpenter in your postwar planning:

1. By starting with Carpenter Stainless Steels, which, through rigid control in manufacture, can be counted on to have the same uniform qualities, lot after lot.
2. Through a service program which aims to help Stainless users select the analysis that will best meet the particular fabrication, corrosion, and physical requirements.
3. By taking advantage of Carpenter metallurgical and engineering assistance in solving new and different problems in the use of Stainless Steels. This helps prevent trouble before it starts, speeds production, and reduces fabricating costs.

Take the first step to secure this helpful Stainless design-engineering cooperation by calling in your nearby Carpenter representative. Talk over your problems with him—get the benefit of his long Stainless experience. If you have not already received a copy of our 98-page book, "Working Data for Carpenter Stainless Steels", drop us a line on your company letterhead indicating your title.

The Carpenter Steel Company, 103 W. Bern Street, Reading, Pa.

Carpenter STAINLESS STEELS

BRANCHES AT

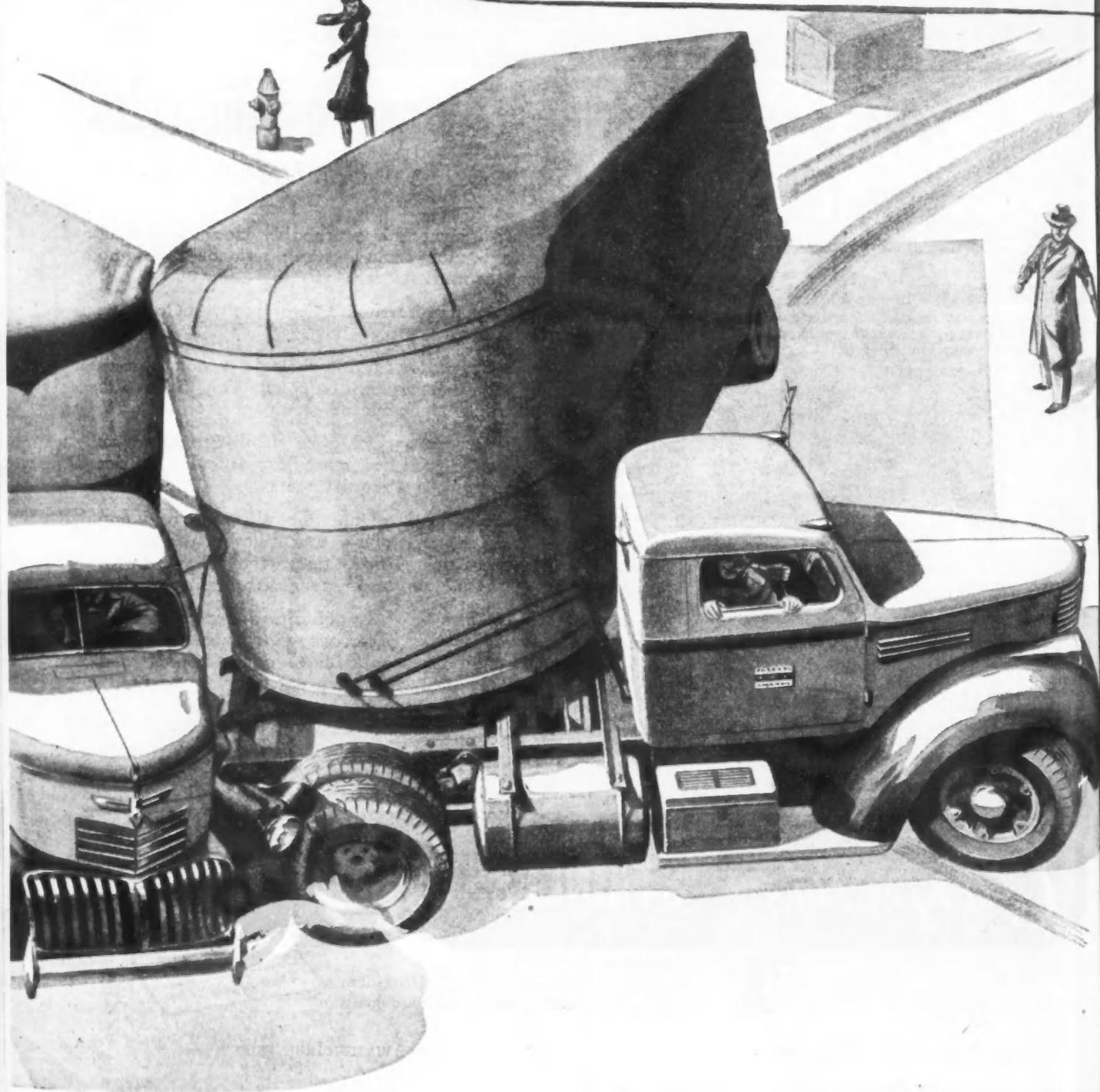
Chicago, Cleveland, Detroit, Hartford,
St. Louis, Indianapolis, New York, Philadelphia



You can AVOID many costly

with

WARNER



ly delays due to Jack-Knifing

★ VARI-LOAD ★ ELECTRIC BRAKES

THERE are many times when it's plenty tough for even the most skillful and experienced driver to cope with road conditions that lead to jack-knifing of big tractor-trailer combinations. And he can't expect help from trailer brakes having a tendency to lag.

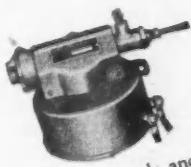
That's when Warner "Vari-Load" Electric Brakes really prove their worth. The *controlled action* of these simple, instant acting, efficient brakes materially reduces the chances of jack-knifing.

*AND NOW . . . with Warner "Vari-Load" Electric Brakes PLUS the New
WARNER CONTROLLER the driver has everything in his favor!*

As soon as slippery road conditions are encountered, the driver can pre-set the "Vari-Load" dial on the dash—so it adjusts the Electric Brakes on the trailer to give correct braking to meet road and load conditions. Then foot pressure on the tractor's regular brake pedal activates the new Warner Controller which provides *complete synchronized operation* of the tractor's hydraulic brakes and the trailer's Electric Brakes. With this *absolute control*, all brakes "come in" at the same time—but with various *amounts* of power. Therefore, rear trailer wheels get the effect of coming in first—and tendency to jack-knife is prevented, thus giving protection to driver and load—and avoiding costly lost time due to wrecked equipment.

WARNER ELECTRIC BRAKE MANUFACTURING COMPANY • BELOIT, WISCONSIN

NOW—Present Owners of Trailers with Warner
Electric Brakes Can Have This New WARNER CONTROLLER

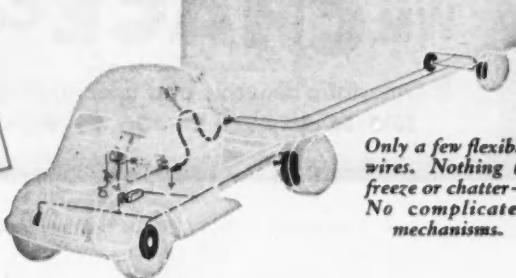


The new Warner Controller — simple and compact — synchronizes the hydraulic brakes on tractor with the Electric Brakes on trailer. The tractor's regular foot pedal operates both braking systems. This development creates smooth foot-touch tractor-trailer braking under all conditions—eases driving strain—assures greater safety. Controller is easily and quickly fitted into hydraulic brake line. See your Warner dealer about changing over your present equipment.

FOOT PEDAL PRESSURE CON-
TROLS BRAKES ON BOTH
TRACTOR AND TRAILER

WARNER

ELECTRIC BRAKES



Only a few flexible wires. Nothing to freeze or chatter—No complicated mechanisms.

**An ALLOY with a
Thermal Conductivity
Only 2%
that of
COPPER**

Thermal conductivity of Chace Manganese Alloy No. 772 is far below the values of alloys ordinarily used for low heat transfer applications. It is less than 50% that of steel . . . less than 10% that of brass . . . and only 2% that of copper.

Barriers of this alloy have been used to reduce heat losses by 50%. Where heat losses tend to upset action—or where handles or other parts of devices must be kept cool—try Chace Alloy No. 772.

This alloy has also high electrical resistivity, 1050 ohms per circular mil foot . . . a temperature coefficient of expansion twice as great as that of ordinary steel . . . a vibration damping constant about 25 times greater than steel. It is available in sheets from .003" up in thickness, and from .0625" to 6" wide . . . in rods down to .125" diameter . . . in wire down to 16 gauge .050" . . . and also in special shapes.

Complete engineering and research facilities available . . . Bulletin No. A-942, giving detailed information, is yours for the asking.

W.M. CHACE CO.
Manufacturers of
Thermostatic Bimetals and Special Alloys
1610 BEARD AVE • DETROIT 9, MICH.

Airframe Design of The Hawker Typhoon

(Continued from page 41)

(V) Rear End of Rear Fuselage: This carries the tail unit, fin and rudder and is attached to the rear fuselage proper by a circumferential riveted joint and a number of longitudinal finger plates. The tailplane is attached to this in a manner similar to the main wing-body junction. The fin is integral with the rear end, as a joint in the skin is necessary for strength. The elevators and rudder are easily detachable units.

(VI) Fuel Tanks: All fuel tanks are independent of the structure, easily removable and self-sealing against enemy fire. The nose tank consists of a duralumin shell shaped to the airfoil contour. Access to the tank attachments is through the bottom surface of the wing and the open N-bracing of the front spar. The top surface of the wing in the vicinity of the main tanks is a permanently attached skin and carries drag loads. The bottom surface is covered by the wheel fairing and detachable panels, which give access to the tank attachments and permit easy removal of the tanks.

The pilot's cockpit is totally enclosed, with two side doors and a hinged roof panel. Normal entry and exist are made from the starboard side by opening the door and lifting the roof panel; in emergency both doors and the roof panel can be jettisoned. The windshield, set at an angle of 45 deg to the horizontal, is of bullet-proof glass, and the head fairing aft of the cockpit is transparent to enable the pilot to obtain a satisfactory view to the rear. Each side door is provided with a sliding transparent panel for flying and landing in conditions of poor visibility.

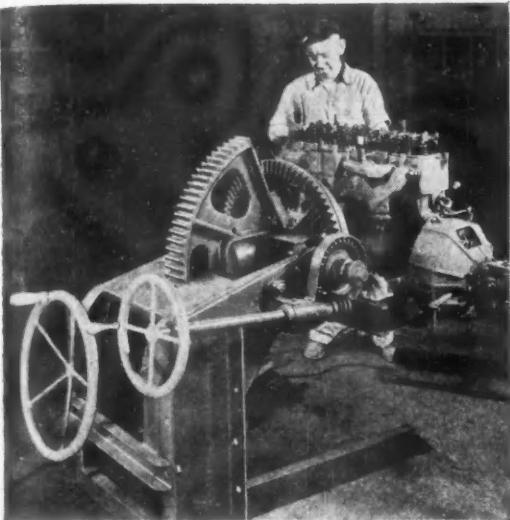
The pilot is protected front and rear by armor plate. Two bullet-proof glass panels are fitted behind the pilot's head on either side of the armor plate. (On some of the latest Typhoons the cockpit cover consists of a single-piece transparent sliding hood of blown shape.) The crash pylon hitherto provided on most monoplane fighters to protect the pilot in case of overturning on the ground has been omitted; with the wide track overturning is very unlikely.

Instruments are normal and flying controls are of the conventional stick-and-rudder-bar type. The rudder bar is adjustable for leg reach and alternative upper and lower positions are provided for the pilot's feet. The seat is adjustable for height and both seat and rudder bar can be adjusted while the machine is in flight. Oxygen equipment is installed.

The wings are tapered in plan and section, with no center wing section, other than short members across the fuselage, the wings extending right up to the body. Each wing is connected to the center fuselage by four pins, two to each spar. This system has proved to give quick and easy fitting and removal of wings.

The main structure of the wings consists of two spars designed to take the flexural loads over their whole

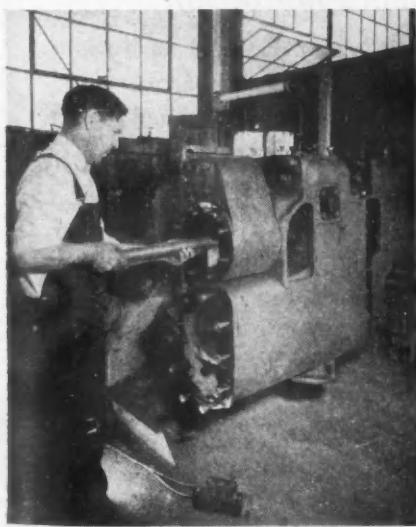
(Turn to page 62, please)



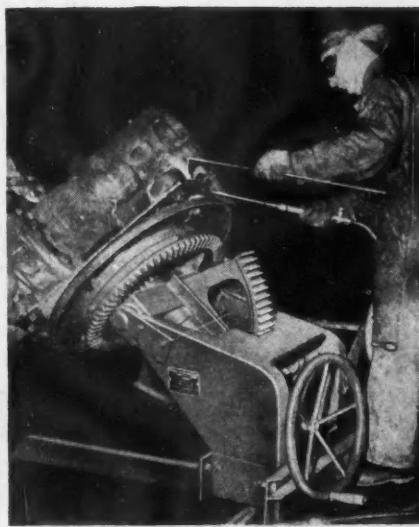
Repairing Engines



General Welding



Overhauling Feedwater Heaters



Repair Welding



Overhauling Locomotive Pumps

POSITIONING

for WELDING AND WORKING

*It's more productive
... more economical*

THE SAVING in time and labor effected by Ransome Positioning Equipment pays for itself in a very short time, and the equipment goes on to help get work done better, more quickly and to cut shop operation costs. Some of the many uses are illustrated on this page, and other uses are listed below.

Standard positioners are available in capacities from 100 lbs. hand-operated to 40,000 lbs. motor-operated.

Ransome engineers will be glad to help with your positioning problems and to make recommendations of proper equipment. Contact your nearest distributor.

POSITIONING EQUIPMENT USES

Welding • Parts assembly • Drilling • Flame hardening
Flame cutting • Hard surfacing • Chipping • Grinding
Cutting • Overhauling • Burnishing • Polishing • Plating

RANSOME POSITIONING EQUIPMENT is now available through a nationwide distributing organization

INDUSTRIAL DIVISION

Ransome MACHINERY COMPANY

DUNELLEN, NEW JERSEY

SUBSIDIARY OF WORTHINGTON PUMP AND MACHINERY CORPORATION

GROWTH THROUGH
Distinguished Service
SINCE 1889

IN EVERY INDUSTRY there are those who pioneer—those who set out, through constant study, research and experiment, to chart the course of progress down which others follow.

Fifty-five years ago, the newly-founded Peninsular organization elected to be a pioneer in the grinding wheel industry. Since that time, Peninsular has originated and contributed many new and important advancements in the fabrication of abrasive wheels—in the machinery for their manufacture—in the methods for their application to modern manufacturing problems.

To accomplish this has not been easy. It has taken time—money—and endless striving. But it

has brought its rewards. And chief of these is the steady, healthy growth that has brought the Peninsular Grinding Wheel Company to the position of leadership it enjoys today.

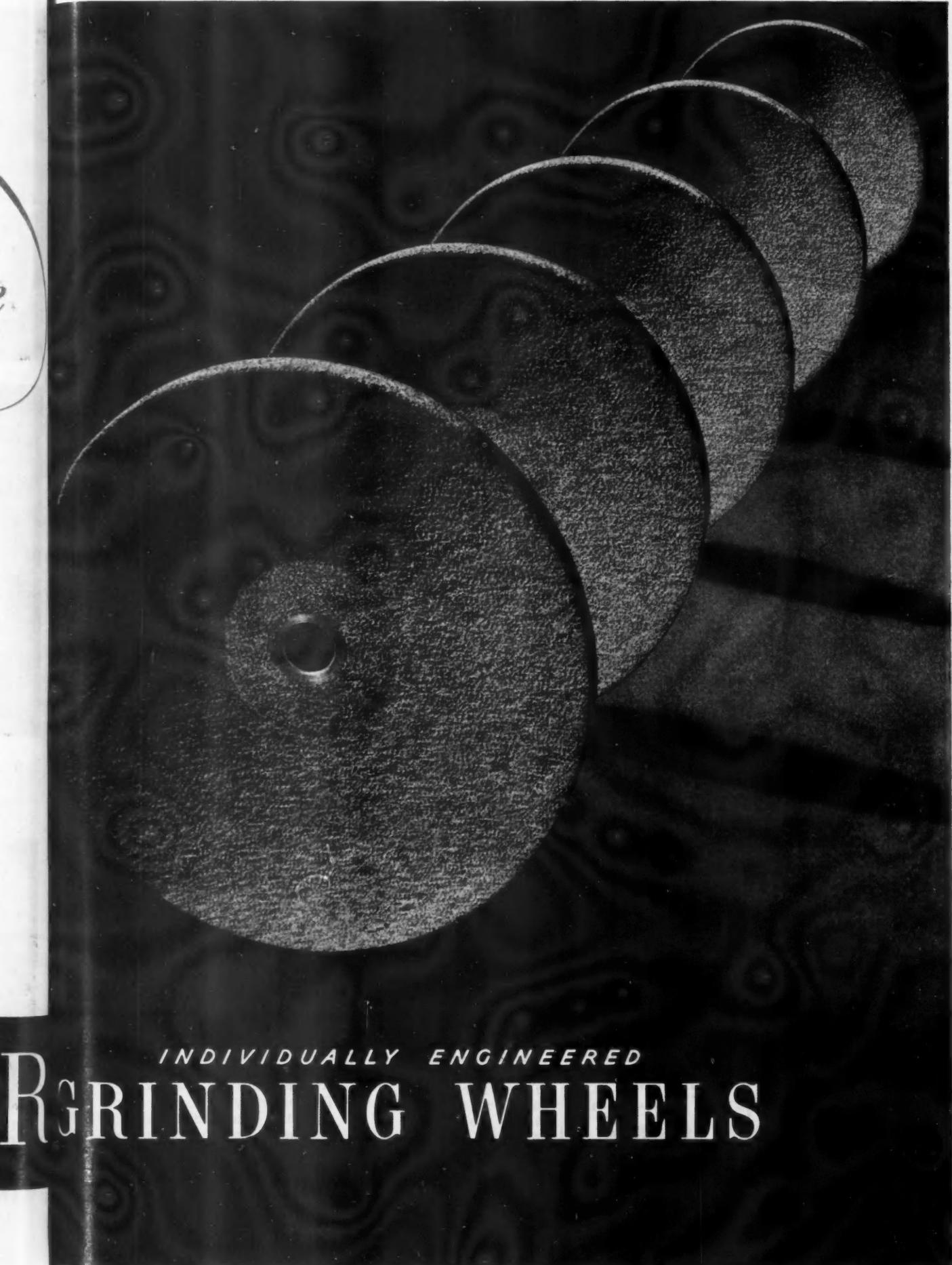
A STANDING INVITATION

Our expert staff of factory and field engineers are ready today to help in your postwar preparation—with a production, engineering and cost analysis service beyond any offered up to now in the industry.

The Peninsular Grinding Wheel Company, 729 Meldrum Ave., Detroit 7, Michigan. Branch Offices: Chicago, Cleveland, Newark, Pittsburgh.

SPECIALISTS IN RESINOID BONDED WHEELS

PENINSULAR
SINCE 1889



INDIVIDUALLY ENGINEERED
GRINDING WHEELS

length and also loads due to differential bending in the inner portion. The two spars are braced together by six main ribs and a number of light ribs. The inner portion of the spars consists of extruded section booms with N-girder webs, and the outboard portions are built up of extruded T-section booms with single plate webs. In the gun bay, a D-section member formed of heavy gage skin takes the torsion and provides the stiffness. Rear of the D-spar are two large gun doors forming the top surface and giving easy access to the guns and the ammunition boxes. Outboard of the gun bay the wing is of normal stressed skin construction, with

two spars and skin reinforced by stringers. This system has been found to provide adequate wing stiffness and strength, while providing a wing that is simple to construct. The flaps and Frise ailerons are metal covered. The flaps (split type) are mechanically connected across the fuselage.

The Sabre engine is mounted with its rear feet on the front spar; thus engine torque is taken out directly and does not have to be transmitted through the engine mounting. The mounting structure proper supports the trunnions for the front feet and comprises a pair of ordinary braced tube cantilevers.

The center fuselage is typical of the Hawker braced tubular construction, giving ready accessibility to the cockpit installation. The rear fuselage is an economical monocoque structure, being devoid of any large opening, such as the cockpit. The design embodies the usual bulkhead wings and longitudinal stringers. On a strong bulkhead at the forward end are four joints which are built into the monocoque portion and provide means of attachment to the braced tube center fuselage. Another strong bulkhead at the aft extremity picks up the tail unit.

Of the cantilever monoplane type, the tail unit is an all-metal structure with metal stressed-skin covered fin and tailplane, metal covered elevators and fabric covered rudder. Trim tabs, adjustable from the cockpit, are provided in all movable surfaces.



an ANTI-FRICTION WORLD

EVERY HEADLINE PULLS IT CLOSER TO REALITY—a world that will benefit from the brilliant inventive triumphs of war production; truly an Anti-Friction World. We know . . . for Aetna is helping to plan and achieve it.

Scores of new products, hundreds of old products redesigned; will operate more smoothly, more economically—countless war-worn plants will be revamped, rejuvenated: all by judicious application of anti-friction bearings.

Have you made sure that your product and your plant will be ready for tomorrow's competition?

Aetna can help you. Time used for laying solid foundations of your future business is time well invested. A line or call to us makes the contact. Aetna

Ball Bearing Manufacturing Company,
4600 Schubert Avenue, Chicago, Illinois.

I N D E T R O I T :
SAM T. KELLER,
7300 WOODWARD
AVENUE, PHONE:
MADISON 8840-1-2.

MAKERS OF
THRUST BALL BEARINGS,
Standard and Special
ANGULAR CONTACT
BALL BEARINGS
ROLLER BEARINGS
. . . Special,
BALL RETAINERS
HARDENED and
GROUND WASHERS



Aetna **BALL BEARINGS**

Mirror-Image Template Reproductions

(Continued from page 27)

image reproduction providing the original was perfectly flat and had no surface irregularities. This condition is rarely encountered. In order to improve the quality of the reproduction under production conditions the blank stock was given several coats of paint.

"Considerable pressure is required in this method which introduces the possibility of damaging the offset blanket. In order to protect the blanket and at the same time increase the pressure, a sheet of .050 in. rubber was placed over the metal before rolling with the press cylinder. As an example of the pressures applied, the total thickness of the original (.050 in.), painted stock (.055 in.), and rubber (.050 in.) was .155 in. The press bed was set as high as .075 in., which meant that the rubber and offset blanket had to compress a total of .080 in.

"It should be noted that in order to prevent slippage between the original and reproduction the blank metal was jig-drilled and held to the press bed with locating pins.

"*Intermediate Blanket:* The scribed original was fastened to the press bed with double-coated Scotch tape and inked in the usual manner. Intermediate blankets of various materials were carefully laid over the original and the press cylinder rolled over them. The materials were then removed from the original, turned over, and replaced. The press cylinder was again rolled over the intermediate blankets, this time picking up the ink impression and transferring it to a piece of metal on the other press bed. All reproductions made as mirror images were trammelled in several locations lengthwise, crosswise, and obliquely, making direct comparisons with the original."

Following are the results that were obtained:
(Turn to page 64)

BAUER & BLACK

Industrial Tape

PRESSURE SENSITIVE ADHESIVE

Tape Is Only As Good As the Brains Behind It

By *brains* we mean constructive thinking on specific problems, thinking based on experience and research. Altogether, these things spell an ability to discover new methods of tape application, to create, to improvise . . .

You can't dig out answers to your industrial tape problems by guesswork. Any use of Industrial Adhesive Tape, no matter how simple it seems, should be considered a specific problem. It too often can hold opportunities for reducing costs, increasing production, promoting plant efficiency.

Your problem, as every such problem, is to our specialists, and in our laboratories, an adventure into new worlds of discovery. Our near half-century of experience in adhesive tape-making has ripened our knowledge of how to

solve such problems in the most efficient, the quickest, most economical way.

Why not write to Dept. 312, and tell us when our trained sales engineers can come to discuss your problems with you. There is no obligation.

CASE HISTORY NO. 12

In any plant unexpected shortages of material are serious, but in some major aircraft plants, the problem was chronic. So Bauer & Black technicians, co-operating with these plants' engineers, used an Industrial Tape printed "MINIMUM STOCK," to wrap completely around the danger-line minimum for critical materials. When the tape is broken, it's a sure means of warning personnel to requisition more parts. Simple? Yes. But the answer didn't come by guesswork, but by study and ingenuity, to find the *right* tape for the job.

A product of

(**BAUER & BLACK**)

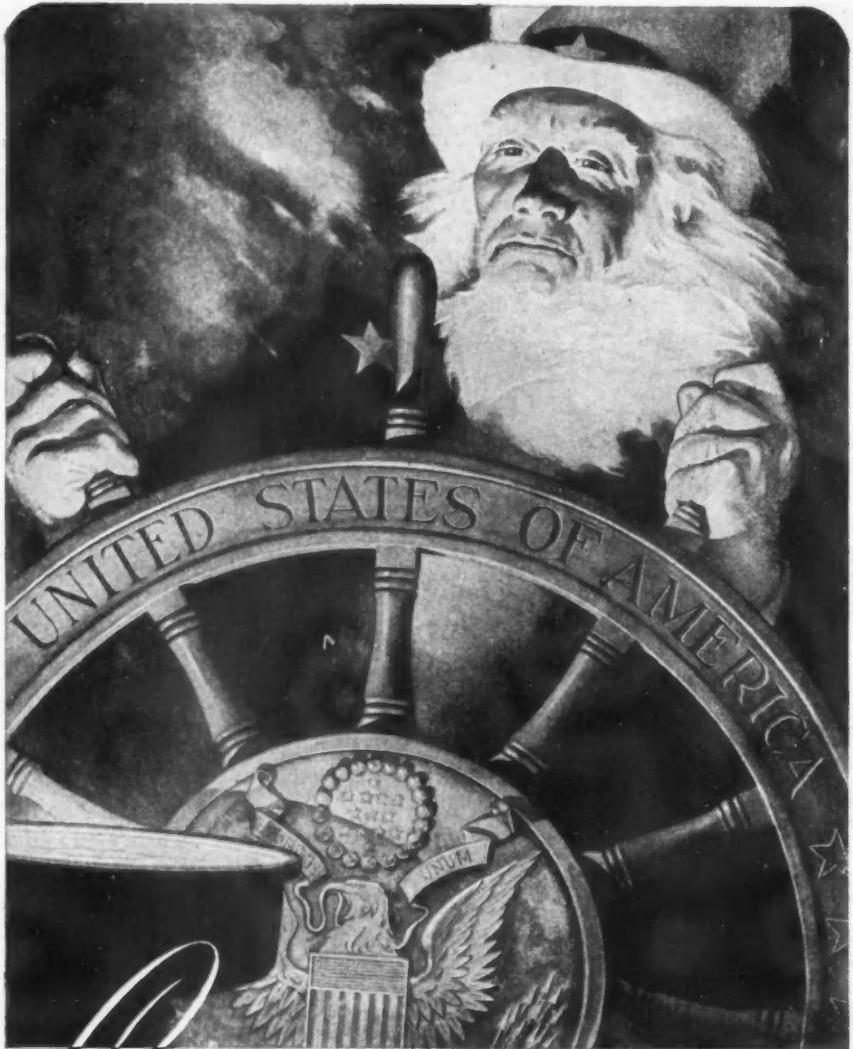
Division of The Kendall Company

2500 SOUTH DEARBORN ST., CHICAGO 16, ILLINOIS



RESEARCH TO SPEED AND
IMPROVE METHODS . . .
PRODUCTION SHORT CUTS
TO REDUCE COSTS

* * *



Continuing on with Confidence-

FOR the second time in one generation this country is turning the tide of victory in a great war. Abroad, our armed forces have shown what free men can accomplish. At home, free enterprise has proved itself by the tremendous volume of its production.

Acme Aluminum Alloys, Inc. is itself a product of free enterprise. Little known in 1919, it is now among the leaders of its industry. The growth of companies like Acme is proof that the free enterprise system remains vigorous and strong.

Free men and free enterprise are steering this country through a great crisis. Free men and free enterprise can continue on with confidence, whatever the future may bring.



"Contact: Reproductions made by the Contact Method have very weak background densities, and in areas where the original is oil-canned to the slightest extent blank areas in the reproductions may occur.

"The use of painted stock did not improve the ink pickup and although the contrast was slightly improved the background continued to lack density. The results were such that painting was felt to be an unnecessary expense.

"The use of a protective rubber sheet is recommended in order to protect the offset blanket. Since little improvement was noted in the reproductions under varying pressures up to the maximum described under Methods of Testing, the minimum compression of .015 in. is recommended.

"Determinations of the accuracy of this method showed zero deviation of 44½ in. lengthwise and 24½ in. crosswise.

Intermediate Blanket: Mirror image reproductions made with a number of different materials as intermediate blankets were found to be inaccurate because of slippage and/or distortion.

"It should be noted that mirror image reproductions made with the use of brown wrapping paper as an intermediate blanket at times produced promising results. However, these were not consistent. It is believed that this material could be used for the production of mirror images approximately 2 ft square providing the reproductions are accurately checked against the originals.

"Mirror image reproductions made with the offset blanket cemented to a sheet of .051 in. by 3 ft by 5 ft Paintlok produced the best density background with the highest degree of accuracy. This was accomplished in spite of the fact that the portion of the blanket used was taken from an old offset blanket which was in very poor condition. The use of new offset blanket material cemented to Paintlok should give better quality reproductions when handled with care. It is recommended that three different sizes of intermediate blankets of this type be made available, approximately 2 ft by 2 ft, 3 ft by 5 ft, and 4 ft by 7 ft.

"The 3 ft by 5 ft intermediate blanket used in this test was jig-drilled and fastened to the bed of the press with locating pins during the initial rolling and image pickup, and this procedure is recommended for production purposes.

"A compression of approximately .015 in. was required to produce a good density background using a dense offset black ink."

Aetna Changes Corporate Name

Announcement comes from the Aetna Ball Bearing Manufacturing Co. that the company's name has been changed to "Aetna Ball & Roller Bearing Company." This change will not affect the company's personnel or policies.



Jap Flat-Top Meets Its Doom

* JAMES M. SESSIONS

NO. 12 OF A SERIES HIGHLIGHTS OF WORLD WAR II PRESENTED BY TUBE TURNERS (INC.) LOUISVILLE, KY. SEE OTHER SIDE

"I'M GETTING TUBE TURNS' OPINION ON ITS FORGE-ABILITY"



Perhaps you have a part or product that forging would improve . . . or a present forging job that could be bettered in precision, cost or service.

We welcome opportunities to tackle difficult upset or press forgings, in either steel or light metals. At Tube Turns you'll find a stimulating kind of cooperation — in which practical forging skill and engineering knowledge are accented by resourceful thinking and original techniques. You'll find laboratories that offer virtually every modern method for mechanical, chemical and electrical research and testing. You'll find ample production facilities for volume output plus exacting accuracy — upsetters and presses in sizes up to the largest, heat treating furnaces of the most recent types and one of the largest die shops in the country.

That's why you often hear it said, "I'm getting Tube Turns' opinion" . . . and its sequel, "We're giving Tube Turns the job." —TUBE TURNS (Inc.), Louisville 1, Ky.

**DO ANY OF THESE STEEL AND ALUMINUM
FORGINGS BY TUBE TURNS GIVE YOU IDEAS?**



TUBE TURNS *Forgings for Industry*

How Car Manufacturers Are Rehabilitating War Veterans

(Continued from page 18)

job operating in the plant without extensive vocational rehabilitation are placed in Group 5 and referred to the nearest Veterans Rehabilitation branch.

Although medical records are usually kept confidential, it is necessary in the case of handicapped persons to obtain the consent of the individual to discuss his situation with the personnel representatives and supervisory employees so that necessary attention can be paid to physical disabilities in job assignments. It also is impressed on supervisory personnel that a normal confident mental attitude may not prevail in a handicapped individual and that patience and understanding must be exercised.

Ford Motor Co. is drawing on its extensive experience in the employment of handicapped persons in setting up its veterans placement and rehabilitation program. Center of the program is the medical transfer division of the medical department which for years has selected jobs for physically handicapped employees, following up their progress and arranging transfers when necessary. Although the division's files contain a general breakdown of types of jobs in each department of the plant, no detailed classification of the suitability of each of these for different types of physical disabilities has been made. Instead the experience and judgment of a special staff of investigators are relied on to make the proper placement.

First step in the re-employment of veterans is an interview to obtain as much background as possible on the man's war experiences as related to the cause of discharge. He is then sent to the medical department for a physical examination. The examiner makes out a special form specifying the type of present disability, if any, and estimating its seriousness. In some cases, the doctor recommends the type of work he deems suitable; in others the decision is left to the medical transfer division. A staff member then takes the man into the shop for a look at the proposed job and a talk with the foreman before a definite decision is made.

A sticker marked "medical case" is attached to the employment record of all medically discharged veterans. Such a man cannot be transferred to a different type of work without the approval of the medical transfer division.

If there is any doubt that the veteran will adapt himself successfully to the job assigned him, a follow-up check is made from time to time. In other cases the superintendent or foreman is asked to keep watch of the man's progress.

Another phase of the Ford veteran rehabilitation program is the operation and expansion of Camp Legion, a 500-

acre school and home, located at Dearborn, Mich., to which all veterans who have been given a medical discharge from the armed forces are welcome. Here the veterans have an opportunity to become rehabilitated to civilian life and to learn a useful trade which may be applied in Ford plants or anywhere else the veteran chooses to work following completion of his stay. He is paid \$3 a day in addition to his board and

room while at the camp. In other words, he receives a monetary scholarship.

On the farmland surrounding the camp, the veteran can learn agricultural methods, including the handling and repair of farm equipment. A modern machine shop is available with instructors to teach molding of plastics, tool grinding, pattern making, auto mechanics, foundry casting, cabinet making, and other shop practices. Since the camp actually is an adjunct of the Henry Ford Trade School, necessary theoretical background also is available. Under individual instruction, the veteran can study shop arithmetic, algebra, geometry, trigonometry,



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Trimming formed parts . . . Cutting Sheet Steel, 1-inch Armor Plate, Plastics or what have you . . .



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"The process is so spectacular that they refuse to believe their own eyes" — so writes the chief tool research engineer for one of the largest aircraft corporations. Previous cutting costs are radically reduced. difficult and slow cutting of certain materials made swift, easy and safe. By all means write for your copy of "FRICTION SAWING" by Arthur A. Schwartz, Chief Tool Research Engineer, Bell Aircraft Corporation which will soon be off the press. It's free.

THE TANNEWITZ WORKS GRAND RAPIDS 4, MICHIGAN

mechanical drawing, blueprint reading, precision instruments, chemistry, industrial electricity, auto mechanics, radio, and plastics.

Another training phase of the Ford veteran program is the inauguration of a plan under which any returning veteran, regardless of his previous connection with the company, can apply for an earn-while-learning, full-paying apprenticeship through any Ford dealer in the United States. If the applicant is accepted, he will be taken in as a member of a dealers' organization and will be given extensive training in all branches of sales and service. Upon completion of his training, he will be

given the opportunity to enter business for himself.

Studebaker Corp. has as yet experienced no difficulty in absorbing its returned war veterans. Those who have been discharged for reasons other than physical or mental disorders are assigned through regular procedure. A man who has been crippled or who has suffered shock is turned over to Earl Warrick, head of Studebaker shop training, who gives each case individual attention. After interviewing the veteran, he endeavors, through his shop experience, to place the man where he can make the best use of his abilities. After the veteran is as-

signed, Warrick keeps close check on him, not with the idea of paternalism, but to assure the employee of sympathetic treatment. If he appears discontented in his job, he is again interviewed and may be transferred, because Studebaker tries to give the veteran work that he not only can do, but also that he can be happy doing. The company does not pretend to be expert in the handling of neurotics, but follows the "horse sense" method of placing them where distractions will be at a minimum. In some instances it may be determined that the veteran needs exercise, so he may be assigned to warehouse work. In others, he may be better off at a desk or bench. In any event, his progress is periodically checked through his department supervisor.

During the last few months, Studebaker has put to work several men who have lost limbs. A one-armed man was employed as a plant protection officer. Another one-armed man hangs parts on a conveyor line. Veterans who have lost the use of one leg are on inspection and desk jobs. The company has as yet set up no special courses for training of returned veterans and cannot at the moment tell whether such a plan will be necessary. It has available, under arrangement with the Government, the facilities of the South Bend high schools, where employees are offered day and night courses.

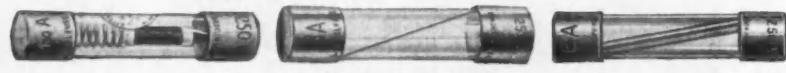
Chrysler Corp. has had, for the past several years, a well integrated program for the placement of partially disabled employees in jobs best suited to them. The experience gained in the placement of partially disabled civilians has been applied to the placement of partially disabled veterans.

Some years ago, the company made a survey of each machine and operation to determine the physical functions required of the operator. Each machine and operation was evaluated as to whether it requires standing, sitting, climbing, lifting, stooping, near vision, distant vision, use of hands, feet, exposure to irritants, etc. Each function was designated by a code number and each machine or job was rated by a series of numbers indicating the functions required by that job. For example, if a given job requires climbing, lifting and good near vision, the codeing for the job would be 40, 50, 70.

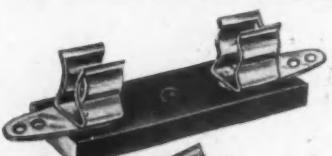
The returned veteran, along with other new employees, is given a physical examination. If a handicap is discovered that makes him unable to perform a specific physical function safely, his record is noted with a code number designating the handicap. For example, if he has a condition which prevents him from lifting, he is given the number 50. When his record is matched with the function rating of a machine or job, and the number 50 appears as a requirement of the job, it is apparent at a glance that he is disqualified for that particular operation. The matching process is continued until several

(Turn to page 72, please)

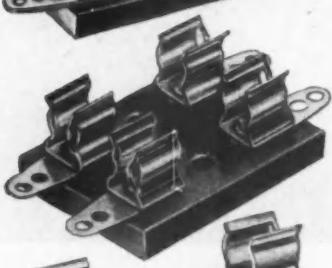
Littelfuse FUSE MOUNTINGS for 3 AG FUSES



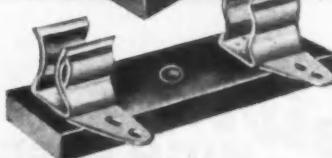
Fuse Size: $\frac{1}{4}$ " dia. x $1\frac{1}{4}$ " long



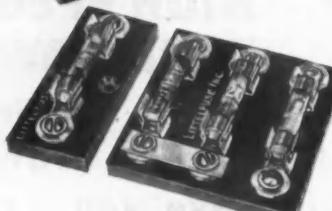
DEPENDABILITY, strength, and long service in single, double, and multiple-pole mountings are outstanding characteristics of these Littelfuse units.



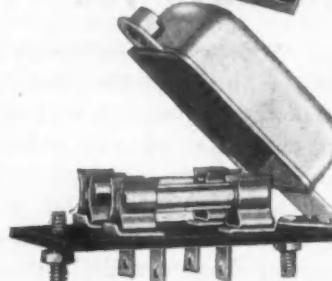
OPEN TYPE SINGLE POLE MOUNTING No. 351001 (old No. 1060). Black bakelite base, overall length $2\frac{1}{4}$ ". Base width $\frac{1}{2}$ ". Live parts space insulated. Shakeproof tinned terminals. Mounting hole for No. 6 R.H.M.S. Nickel-plated phosphor bronze fuse clips.



OPEN TYPE DOUBLE POLE MOUNTING No. 351006 (old No. 1068). Same as single pole above, but double pole, with bakelite base $1\frac{1}{2}$ " width.



ECONOMICAL, LIGHT SINGLE POLE MOUNTING No. 351003 (old No. 1128). $1\frac{1}{2}$ " long x $9\frac{1}{16}$ " wide x $9\frac{1}{16}$ " high overall. Bakelite mounting strip with $1\frac{1}{32}$ " bottom fibre insulator, covering all metal parts for mounting on metal panel. Mounting hole for No. 6 R.H.M.S. Nickel-plated phosphor bronze fuse clips.



UNIVERSAL FUSE PANEL, NO. 1505 SERIES Standardized units for 10 fuse sizes, any practicable number poles. Strong. Light. Send for blueprints.

COVERED TYPE DOUBLE POLE MOUNTINGS No. 351008 (old No. 1237-A). Metal-shielded cover fibre-lined, meets Underwriters' requirements. Cover hinged to bakelite base. Requires $1\frac{1}{8}$ " x $1\frac{1}{8}$ " hole in panel. No. 351009 (old No. 1237-B) double pole with extended fibre liner. Underwriters' approved.

Also made in single pole type.

Littelfuse mountings made for all fuse sizes. Ask for details.

LITTELFUSE INCORPORATED

4757 Ravenswood Ave., Chicago 40, Ill. 200 Ong St., El Monte, Calif.

"Put it on the Blanchard"

...GET THESE ADVANTAGES

Production ✓

Adaptability ✓

Fixture Saving ✓

Operation Saving

Material Saving

Fine Finish

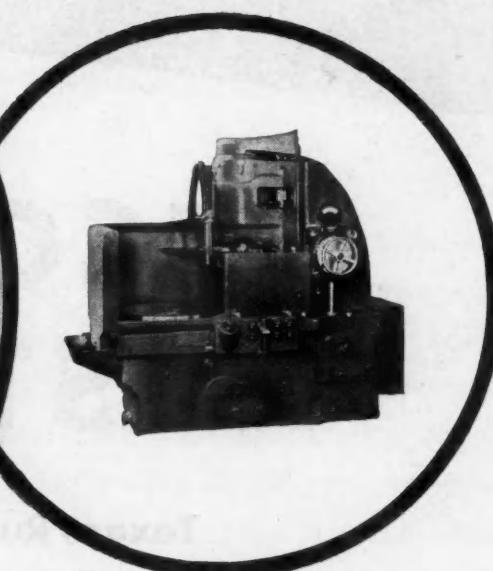
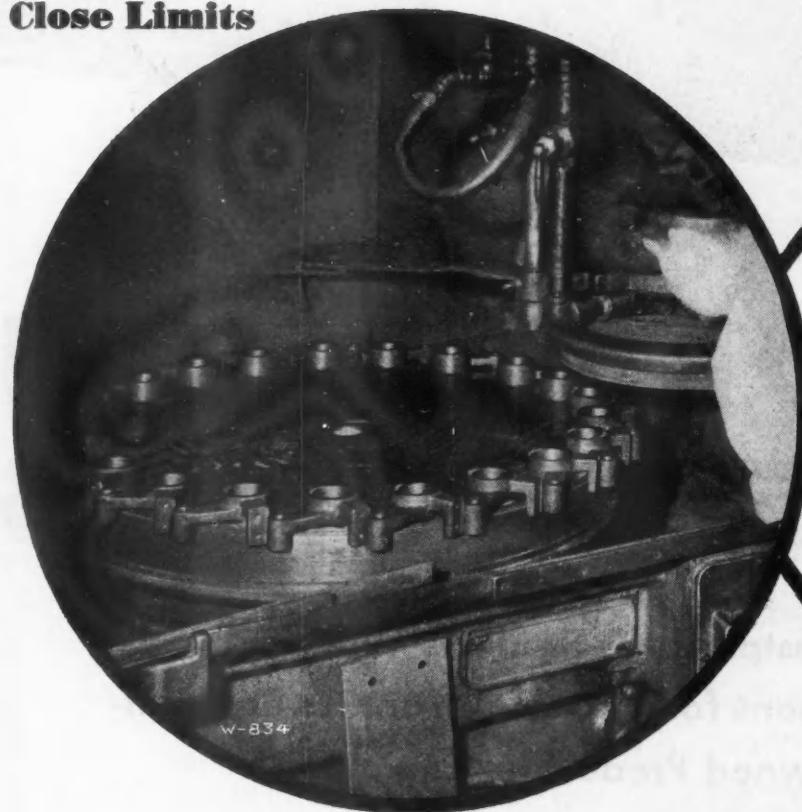
Flatness

Close Limits

Grinding Pawl Arms

These are cast iron pawl arms with projecting bosses on one side at the ends of the arms. They are held on the 36" chuck of a No. 18 Blanchard Grinder with the projecting bosses extending down outside the chuck.

Twenty-one pieces are placed on the chuck at one time and two loads or thirty-two pieces are ground per hour, removing $\frac{3}{16}$ " of metal.

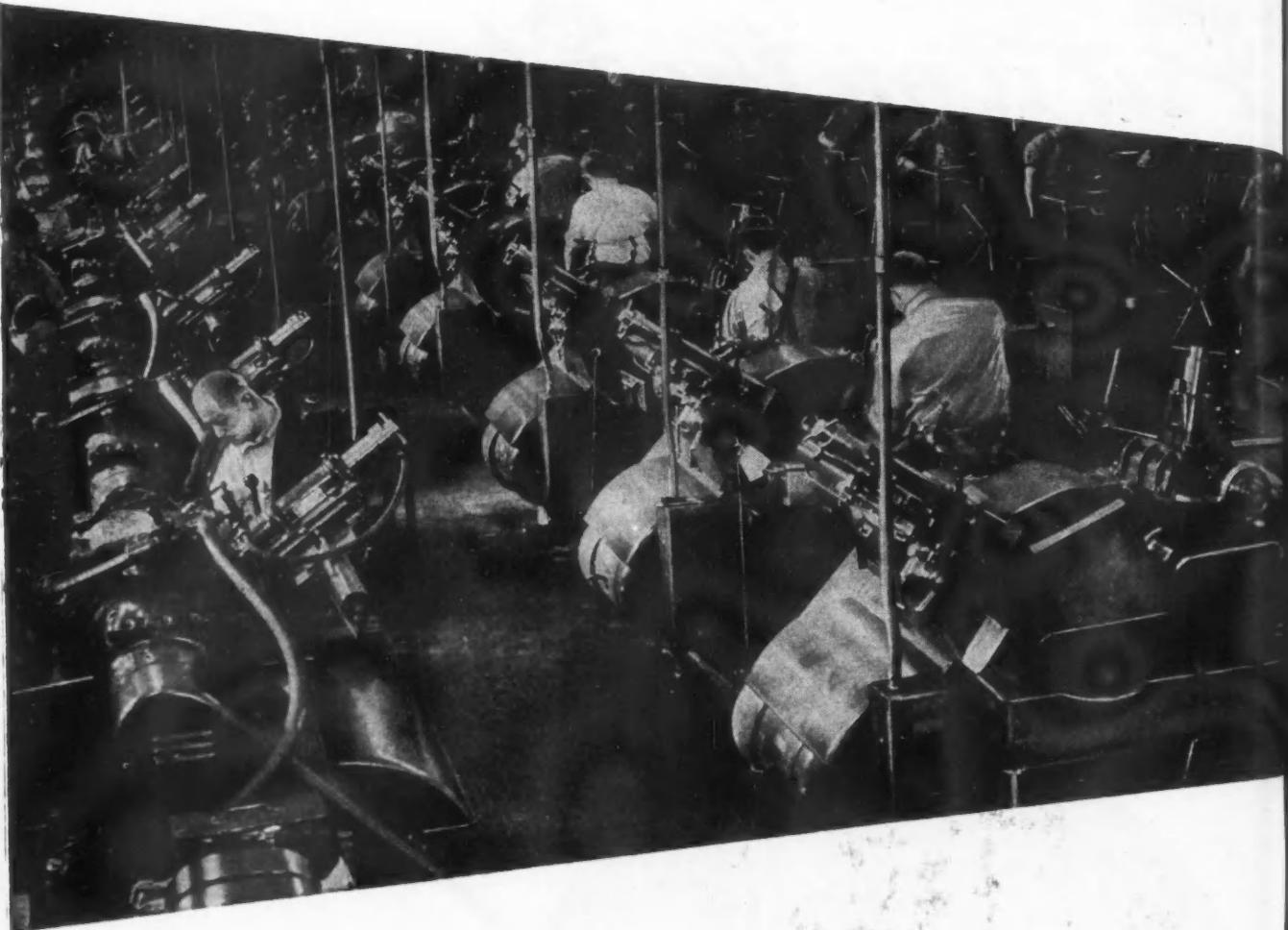


No. 18 BLANCHARD SURFACE GRINDER



Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

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RECONVERSION RUSTPROOFING

Texaco Rustproofing Products Meet Ordnance
Specifications for Application on Government-
Owned Production Equipment.



TEXACO

TUNE IN THE TEXACO STAR THEATRE WITH JAMES MELTON SUNDAY NIGHTS



OFFICIAL INSTRUCTIONS FOR RECONVERSION RUSTPROOFING

are contained in Ordnance Specification P.S. 300-4. This deserves your most careful consideration.

NO RDNANCE Instructions for processing, packaging, packing and marking of production equipment, as contained in Ordnance Specification P.S. 300-4, are extremely exacting.

To meet these specifications for processing machines, precision tools and other production equipment plant operators must use Government-approved rustproofing materials.

Texaco rustproofing materials meet Gov-

ernment specifications. They are easily applied through the medium of brush, dip or spray, and provide a protective coating that will assure the preservation of this materiel for years. No matter what your rustproofing requirements, get in touch with a Texaco representative through any one of more than 2300 Texaco distributing points in the 48 States, or write to The Texas Company, 135 East 42nd Street, New York 17, N. Y.

Rustproofing Products

METROPOLITAN OPERA BROADCASTS SATURDAY AFTERNOONS

jobs are found which do not have the code number 50. The applicant is then functionally qualified for that group.

Following his physical examination, the veteran is placed in one of three categories: (1) suitable for any job; (2) suitable for selective placement; or (3) not physically qualified for any job.

Veteran rehabilitation programs similar to those discussed in this article either have been instituted or are being organized throughout the automobile industry, but due to the extensiveness of this undertaking it is impossible to describe all of them here and instead we have presented a few typical examples.

BOOKS . . .

A GLOSSARY OF FOREIGN WELDING TERMS, published by the American Welding Society, is now available to supplement standard or engineering dictionaries. Contractors, students and others who may have occasion to consult welding drawings or specifications using German, French, Russian or Spanish terms will find the glossary valuable. Many of the terms for which English definitions or equivalents are given have been derived from foreign technical literature and are not found in any standard or technical dictionaries. The glossary is published as a paper-covered pamphlet of 16 pages. The price is 50 cents

and it may be purchased from the American Welding Society, 33 West 39th Street, New York 18, N. Y.

"PLASTIC WORKING OF METALS AND NON-METALLIC MATERIALS," by E. V. CRANE, is the third edition of a standard work on press practice, stemming from the original text—"Plastic Working of Metals." The new edition has been expanded in scope to cover plastics and non-metals by the addition of three new chapters. One deals with the use of semi-permanent die materials for limited lot production (as exemplified by aircraft practice); another discusses the behavior of many materials in the several states of plasticity; the third considers the application of plastic flow methods to the molding of nonmetallic as well as metallic powders and the forming of sheet plastics. The text presents an interesting combination of fundamental research data and practical application. The publisher is John Wiley & Son.

The 1944 edition of the book "A.S.T.M. STANDARDS ON RUBBER PRODUCTS (With Related Information)" is a greatly enlarged one. It gives in their latest form all of the A.S.T.M. specifications and test methods covering rubber and synthetic rubber products, and this year includes much supplementary material.

About 140 pages are devoted to the general methods of evaluating rubber, covering such items as chemical analysis, sample preparation, accelerated aging, cure, adhesion, abrasion and tear resistance, hardness, compression set, changes in liquids, etc. The latest specifications for rubber and synthetic rubber compounds for automotive and aeronautical applications are given and there are five standards on rubber hose and belting and four on gloves and tape, while the important items on insulated wire and cable include one standard test and eleven specifications. There are sections devoted to latex, sponge products, coated fabrics, packing, non-rigid plastics, electrical tests, and nomenclature and definitions. Furnished with the book are War Emergency Provisions and Specifications.

This 436-page book (1943 edition was 300 pages), heavy paper cover, can be obtained from A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia 2, Pa., at \$2.00 per copy.

"THE THEORY AND PRACTICE OF HEAT ENGINES," by D. A. Wrangham, head, mechanical and civil engineering departments, Sunderland Technical College, England, represents a modernized treatment of thermodynamics and engine practice based upon recent advancement in the arts and sciences. The subject is introduced with a chapter on molecular theory and concepts of chemistry which should be of great value to the student. One of the features of the text is the free use of colors in illustrations, charts, and diagrams, making for ease of visualization. A few of the chapter headings will provide the clue to the arrangement of the subject matter—kinetic theory of gases, expansion of gases and ideal cycles, vapors, entropy, reciprocating steam engine, refrigeration, flow of heat, steam condensers, theory of the steam turbine, combustion, internal combustion engines—oil, gas, and diesel, steam boilers, plant economy. The text is profusely illustrated and replete with practical problems for solution. Published by the Cambridge University Press.

COMPOSITE AIRCRAFT MANUFACTURE AND INSPECTION, by Leno C. Michelon, Lieutenant (j.g.) A-V(S) USNR, constitutes a practical encyclopedia of composite aircraft manufacturing and inspection. It is an indispensable handbook and reference manual for everybody concerned with either of these aspects of manufacture as well as for trainees in the inspection field. The book provides a complete coverage of the basic materials used in manufacturing composite aircraft—the (Turn to page 76, please)

CENTRAL UNIVERSAL HOSE CLAMPS IN

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THE Half Track DEPENDS ON CENTRAL CLAMP-POWER

Central Universal Hose Clamps are supplying vital clamp-power with unfailing dependability to America's war machine.

They are strong enough for every production and service requirement . . . precision built of rustproof, extra-heavy cold rolled steel . . . self-locking . . . cannot strip or loosen . . . able to withstand abnormal pressure, stress, strain and vibration . . . easier to use in hard-to-get-at places . . . quickly attached or removed without disconnecting the line.

A single length Universal Clamp fits hundreds of diameter sizes.

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When requesting sample
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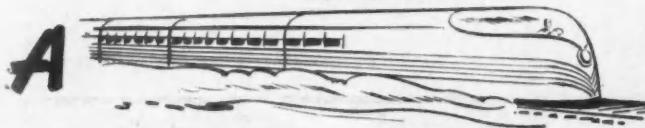
900 SO. WABASH AVE. CHICAGO 5, ILL.



NO "DOCTORED-UP" →

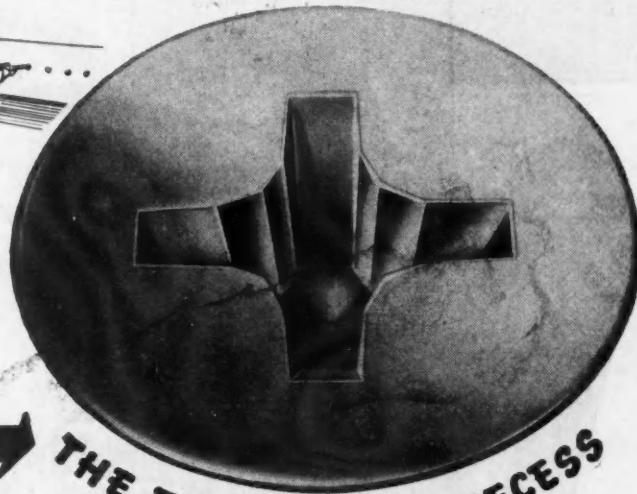


VERSION OF AN OLD IDEA → IT'S



20TH CENTURY

DESIGN THAT TOOK YEARS OF
RESEARCH → 
AND TESTING
TO DEVELOP!



IT'S PHILLIPS → THE ENGINEERED RECESS

In ease and speed of driving, there is nothing quite like the Phillips Recessed Head Screw.

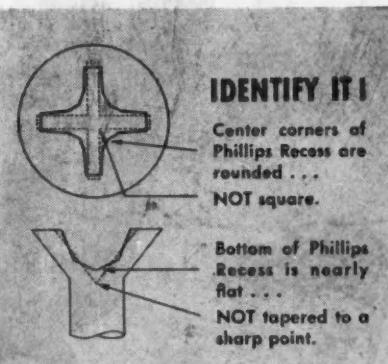
That's because the Phillips Recess was developed from scratch—not just adapted from some older, less satisfactory type of recess. It's an *engineered* recess...with years of costly testing and research behind each design feature.

As a result, every angle, every flat plane, every dimension of the Phillips Recess makes a definite contribution to easier, faster, more efficient screw driving.

The recess walls are angled just right to eliminate fumbling starts, to let workers utilize their *full* turning power. The 16 flat planes are provided to hold even worn drivers snugly. And the depth of the recess is exactly figured to give unusual strength to Phillips Screw Heads, and make it easy to keep Phillips Bits and Drivers lined up with the axis of the screw.

To Make Wartime Quotas
and Peacetime Profits...
get the faster starting—faster driving—stronger, better-looking fasten-

ings that only screws with Phillips Recessed Heads can give you! All over the country, manufacturers are switching to Phillips Recessed Head Screws to speed up assembly and cut costs. Give your assembly department "a shot in the arm"—change to Phillips Screws, too. Available in all head styles, types, and sizes!



PHILLIPS *Recessed Head* SCREWS

WOOD SCREWS • MACHINE SCREWS • SELF-TAPPING SCREWS • STOVE BOLTS

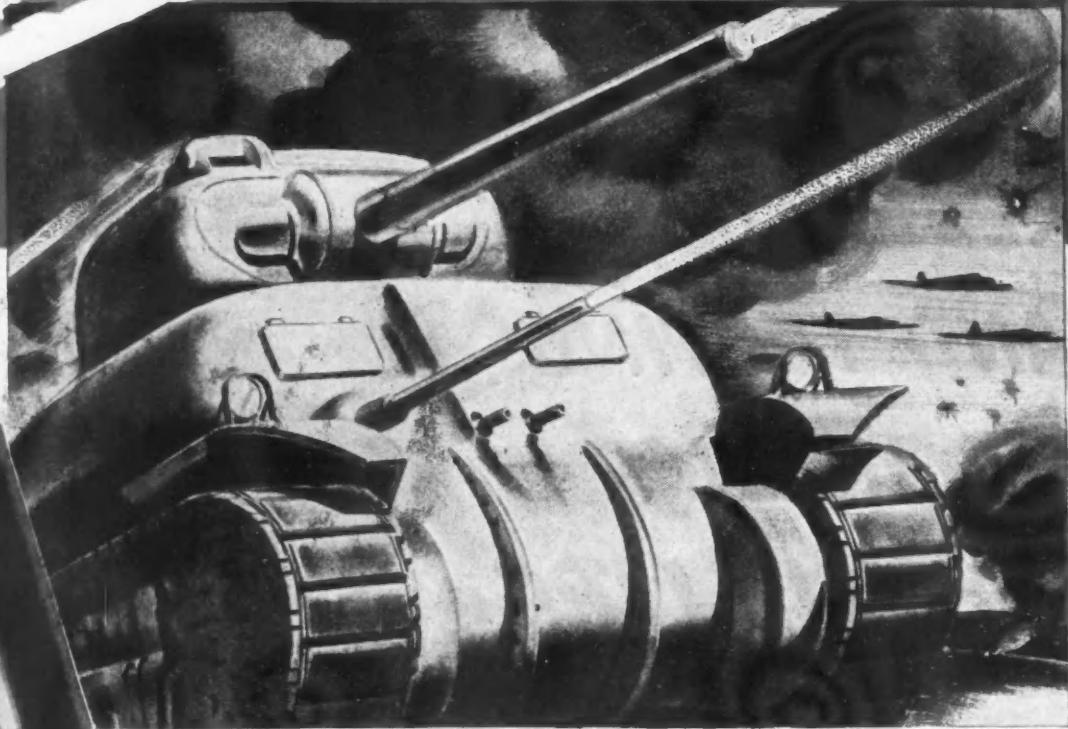
24 SOURCES

American Screw Co., Providence, R. I.
Atlantic Screw Works, Hartford, Conn.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
General Screw Mfg. Co., Chicago, Ill.

The H. M. Harper Co., Chicago, Ill.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
Manufacturers Screw Products, Chicago, Ill.
Milford Rivet and Machine Co., Milford, Conn.
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
Parker-Kalen Corp., New York, N. Y.

Pawtucket Screw Co., Pawtucket, R. I.
Phoebe Manufacturing Co., Chicago, Ill.
Reading Screw Co., Norristown, Pa.
Russell, Burdsall & Ward Bolt & Nut Co., Pott Chester, N. Y.
Seavill Manufacturing Co., Waterville, Conn.
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
Wolverine Bolt Co., Detroit, Mich.

TODAY LOOK



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In all theatres of war . . . on tank destroyers, troop transports, Jeeps, buses and ambulances . . . Monroe Hydraulics have proved they can be depended upon to do a *better job*.



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FOR TOMORROW'S FINEST HYDRAULIC SHOCK ABSORBERS

Higher post-war speed for passenger and freight . . . by motor car, truck, bus or railway . . . will demand the perfection and dependability of Monroe Hydraulic Shock Absorbers . . . the only airplane-type, *triple action* Shock Absorber.

Tested and proved in war and at home . . . Monroe Hydraulic Shock Absorbers feature Economy . . . Comfort . . . Safety and Long Life . . . far above and beyond pre-war standards. For the positive solution to problems involving Hydraulic Shock Absorbers . . . **LOOK TO MONROE.**

DESIGNING ENGINEERS

America's foremost engineers are looking ahead and are incorporating Monroe's Hydraulic Shock Absorbers into their products. They assure top performance under all conditions. Available NOW in sizes to do the job. Our engineers will gladly cooperate with you. There is no obligation. Just write, wire or phone.

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MONROE AUTO EQUIPMENT CO.
Monroe, Michigan

Without obligation kindly send more information about Monroe's Hydraulic Triple Action Shocks for

Automobiles Trucks Buses
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 Service Station Replacement deal and prices.

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LECTROETCH BENCH PRODUCTION UNIT



THE Lectroetch bench production unit is probably the most popular etcher on the market today due to its utility, speed, ease of operation and wide range of work. It can be conveniently placed on operator's bench where it is easy, fast and simple to operate. It is ideal for marking flat, cylindrical and odd shaped parts and will not in any way interfere with surface tolerances.

An inexpensive plastic locating fixture assures consistent uniform register of markings on all parts. This remarkable electrolytic stencil etcher can be operated manually or automatically and handles intricate designs or trade marks as easily and legibly as ordinary characters. They can be operated by anyone without any danger because there are no acids used, no fumes, heat or shock, no stress, strain or deformation on the parts marked.

Send in for free literature; chances are we have the answer to your parts marking problem in one of our standard etching units as shown below.



THE **LECTROETCH** CO.
1727 DOAN
CLEVELAND 12, OHIO

metals, the woods, the plastics, and the fabrics. It gives in exact detail the Army and Navy Aeronautical Specifications for each of these materials. It presents the inspection instruments and methods used to insure adequate performance and maximum safety.

An extraordinary amount of information is contained in this volume. There are 108 tables in the text proper, and many more in the 16 appendixes. The 478 illustrations are an important feature.

This 546-page book may be obtained from the publishers, Harper & Brothers, 49 East 33 St., New York, N. Y., at \$6.00 per copy.

A new textbook on the subject of "MATERIALS AND PROCESSES" published by John Wiley & Sons, in a series in the interest of the advanced engineering program of the General Electric Co., is edited by James F. Young, engineering division of G.E. Based largely upon lectures given by members of the engineering department of G.E., the text provides a broad coverage of the materials and processes used in manufacturing electro-mechanical products. Its scope takes the student from a condensed treatment of metallurgy and heat treating methods through a discussion of basic processes, with emphasis on the design of products to fit modern process methods. In treating materials, the text covers, among other things, magnetic and electrical properties, electrical insulation, and plastics. In the section on processes, the text covers casting, powder metallurgy, hot and cold working, welding, machining, and quality control.

The latest compilation of all A.S.T.M. STANDARDS ON RUBBER PRODUCTS includes 41 specifications, physical and chemical tests for a wide range of products, as well as the emergency alternate provisions and other emergency methods issued to expedite procurement and conserve crude rubber. Committee D-11 on Rubber Products, which is responsible for this book, has developed a number of widely-used test procedures. Some of the newer work of the committee is represented in standard methods of testing rubber cements, latex, sponge-rubber products, and battery containers. Copies of the publication may be obtained from the American Society for Testing Materials, 260 So. Broad Street, Philadelphia, at \$1.75 each.

THE OXY-ACETYLENE HANDBOOK, published by The Linde Air Products Company, fulfills an urgent need for a comprehensive and authoritative textbook on basic oxy-acetylene welding and cutting procedures. This 600-page manual is invaluable as a guide for self-instruction and also as a standard classroom textbook in vocational and trade schools, technical high schools, and engineering colleges. It covers the entire range of the oxy-acetylene process, giving instructions for handling all the common commercial metals, together with simple explanations of the fundamental principles of the various methods of depositing and controlling molten metal.

In addition to its use as a textbook it will also serve as a reference book for plant management people, engineers, designers, superintendents and foremen.

KEEP 'EM CRAWLING — EARTHWORMS AT WAR, by William Haslett Upson. Published by Farrar & Rinehart, Inc., New York.

Many of our readers, no doubt, are familiar with the exploits of Alexander Botts, the impulsive super sales manager of Earthworm Tractors, as related in stories published in the Saturday Evening Post. This book contains a number of Alexander Botts stories, all with a war slant. These stories unfold in the form of letters and telegrams passing between Botts and the president of the Earthworm Tractor Company.

EXAMPLE OF Service:

In a recent letter, a prominent industrial manufacturer writes: "In a turret lathe, which usually required a change of tools after every sixth piece, your Chillo Cutting Oil has increased tool life more than 300% and improved finish." For another "Example of Service" write for your free copy of METAL CUTTING FLUIDS — 26 pages of helpful information. Address: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

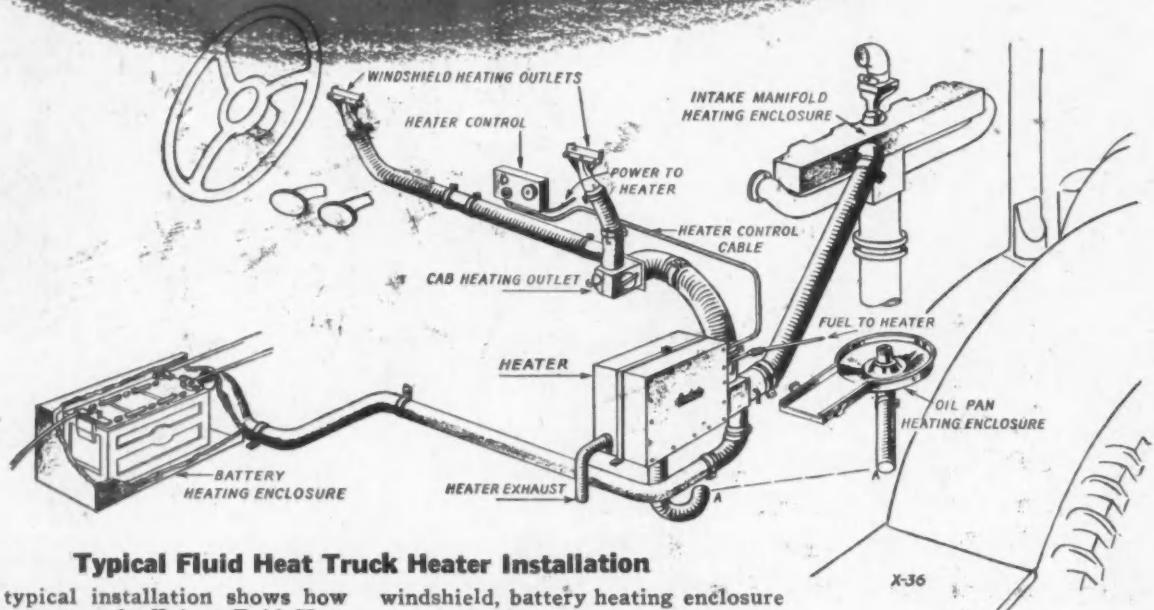
More and more, it's service that counts...
and *Cities Service* means good service!



CITIES SERVICE OIL COMPANY

ARKANSAS FUEL OIL COMPANY

-fluid heat- TRUCK HEATERS UTILIZE



Typical Fluid Heat Truck Heater Installation

This typical installation shows how the compact and efficient Fluid Heat Truck Heater does its all-around job. Heat goes by ducts to the intake manifold heating enclosure, cab,

windshield, battery heating enclosure and oil pan heating enclosure. The entire system is controlled by a switch on the dash.



Fluid Heat's Model SAV-25-110

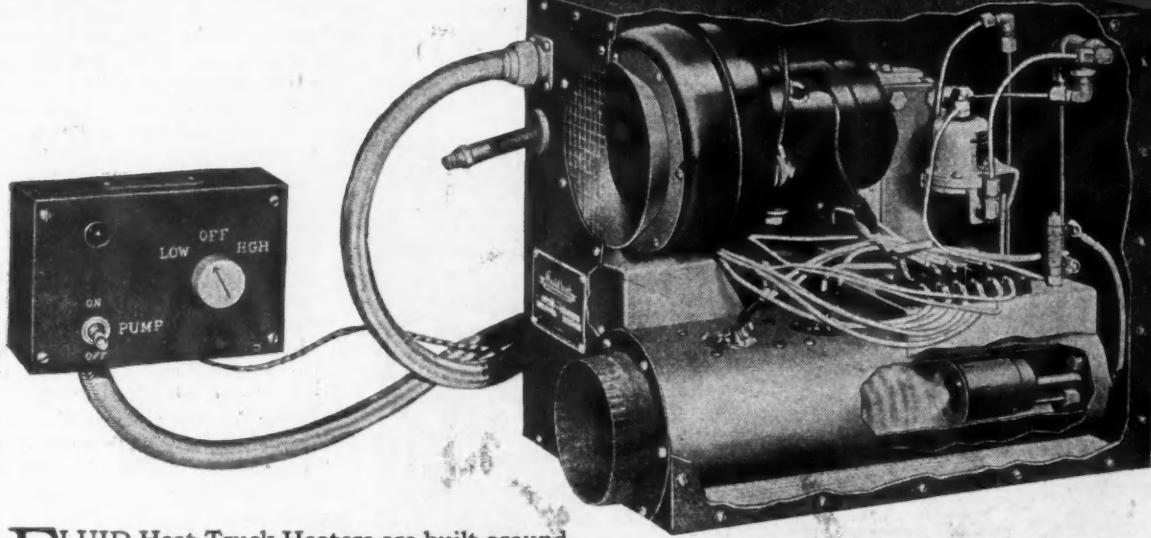
This model illustrates the flexibility of Fluid Heat's heat engineering know-how. Designed by request for use in trailers housing mobile laboratories, it operates on 110 A. C. and delivers 25,000 BTU per hour. Fuel is drawn directly from the tank of the vehicle. Dimensions are 17½ by 10½ by 12½ inches.



Fluid Heat's Model SAH-15T

Designed for trailer and cargo-space heating, this model has an output of 15,000 BTU per hour and has a convenient hand-replenished fuel tank compactly built onto the top. Built-on tank makes the heater a completely independent, self-contained unit, permitting uncoupling of trailer without fussing with fuel lines.

NEW COMBUSTION PROCESS



FLUID Heat Truck Heaters are built around a new heating principle of special advantage in truck heating. Each Fluid Heat Truck Heater employs a vapor-entraining process utilizing pre-heated combustion air. This process accomplishes combustion with an unusually low pressure drop, permitting operation at low combustion air pressures and resulting in small power load. The process produces a completely suspended fire and therefore gives freedom from lead oxide formation. Flame retention is so positive that flame characteristics are the same under all atmospheric conditions.

Fluid Heat's new truck heaters are compact, light, and economical. The operating control is at the heater or from a remote location. Models for trailer and cargo-space heating are available, as well as adaptations for passenger cars. For dimensions and operation details, see illustrations opposite. These heaters are a new development in automotive heating.

Fluid Heat has, for sixteen years, pioneered in the development and manufacture of automatic

Fluid Heat's New Model SAH-20 Truck Heater

This heater has a maximum output of 20,000 BTU per hour, yet weighs only 21 pounds, fits easily on any truck. Overall dimensions are $7\frac{1}{4}$ inches wide, $10\frac{1}{4}$ inches high, 12 inches long. To insure clearance, heater can be placed in almost any position. Pump enclosed in the unit draws fuel direct from the truck's fuel tank. All models operate on 6, 12 or 24 volts D. C. or 110 volts A. C. Model SAH-40, not shown on these pages because it is identical in design, delivers 40,000 BTU per hour. It is 13 inches by $10\frac{1}{2}$ inches by 19 inches, weighs 40 lbs.

combustion and heat transfer equipment. Those years of heat engineering know-how are built into each light, compact, economical Fluid Heat Truck Heater. You'll want Fluid Heat Truck Heaters on the trucks, trailers or cars you design, build or equip. Write for full information on this new heating achievement.

FLUID HEAT DIVISION
Anchor Post Fence Co.
6760 Eastern Ave., Baltimore 24, Md.

fluid heat
TRUCK HEATERS

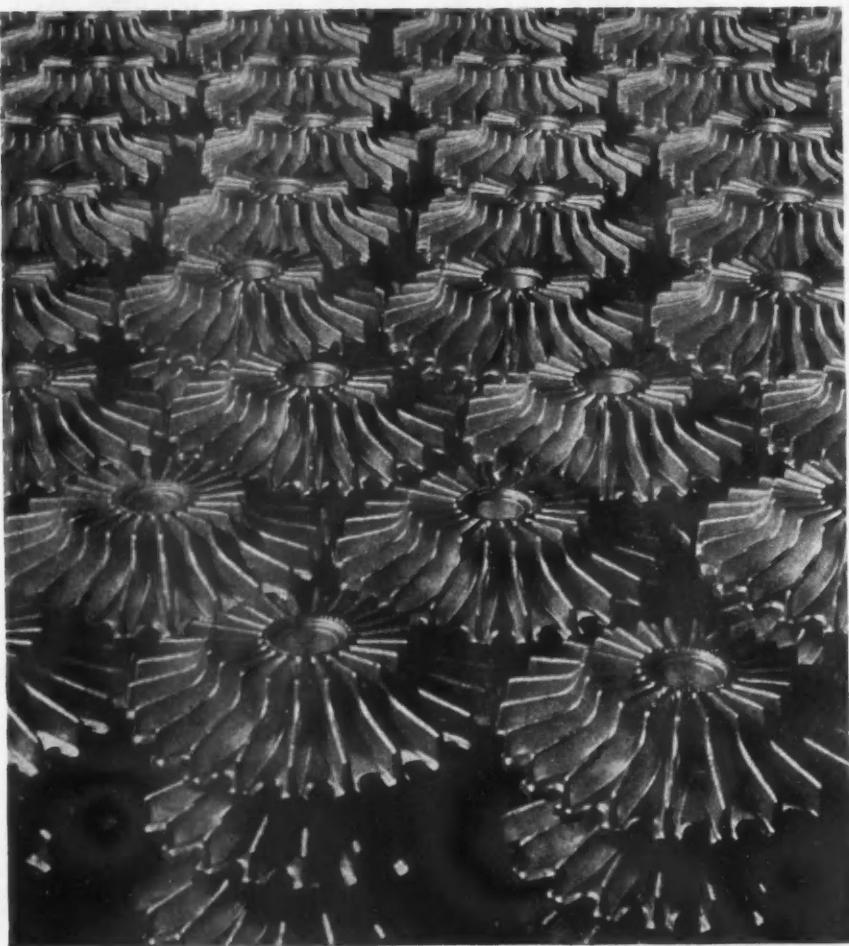
Tube Turns Extends Forging to Aircraft and Automotive Fields

(Continued from page 23)

Finally, the plant is served by a modern tool and die shop capable of producing the dies for upsetters, tools and fixtures for the metal cutting, and the repair of these. Some idea of the facilities for this purpose may be gained from the fact that they have five of the familiar Pratt & Whitney Keller die-profiling machines, supple-

mented with a Cincinnati single-spindle Hydro-Tel, as well as the usual complement of milling machines, drill presses, etc.

For the aluminum forge we shift scenes to the State Fair Grounds, reminiscent of horses and cattle and elephants. Once inside, the observer is impressed with the modernity of layout



Aluminum impeller forgings for aircraft engine superchargers

Forgings — laboratory controlled — strength — toughness — minimum weight that stands up under unpredictable loads.

WYMAN-GORDON
WORCESTER, MASS. • HARVEY, ILL. • DETROIT, MICH.

and equipment, vieing with any similar plant in this country. Principal products are aircraft engine pistons, made in four types; two Pratt & Whitney and two Wright cylinder heads—a new activity shortly entering mass production—cylinder barrel muffs for latest type radial engines, and fuel injection housings.

Material for aluminum forgings is received in the form of bars from the Aluminum Company of America, and from Reynolds Metals, supported with a certified analysis for each batch.

One of the large buildings houses the forge shop proper. Heat treating and finishing facilities, in turn, are located in another building some distance away. Completed forgings, ready for heat treating, are transported on a long conveyor which starts in the forge building, then traverses the long open space between buildings, and completes its circuit in the heat-treating department.

A third building, formerly the home of elephants whose lingering traces have not yet disappeared, serves the function of the cast house. Here are found numerous Dempsey furnaces for the melting and direct-chill casting of aluminum alloys and for remelting scrap, for the casting of special alloys, etc. In addition, there is a large chip furnace for the melting of chips and turnings from the machine shop operation.

The valuable background of forging experience which is the heritage of Tube Turns has developed simplified short-cut methods for producing aluminum forgings in enormous quantities. Thus cylinder barrel muffs are made in a single setting on a 2000-ton H-P-M Fastraverse hydraulic press.

Pistons are produced on 8-in. Ajax and 9-in. National upsetters. Four-station dies are used, completing the job in one heating. Interesting feature of these dies is that they are cut in two rows of four stations each. Thus when one row requires maintenance due to breakage or wear, the die block is turned around to present the second set of the unused die.

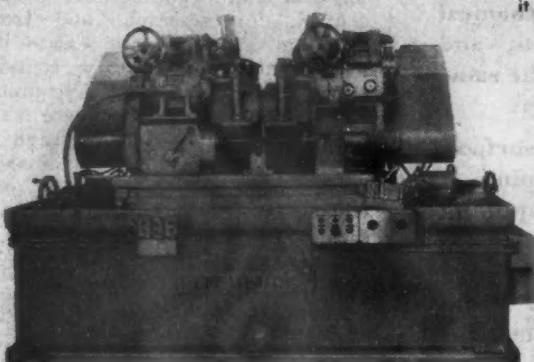
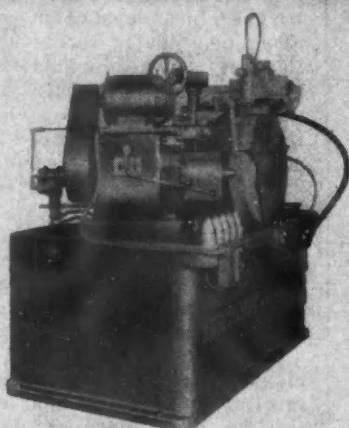
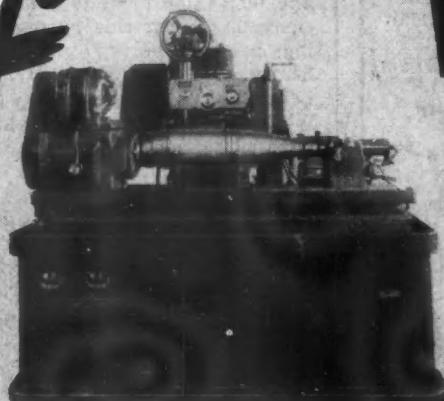
Forged aluminum cylinder heads, a comparatively new venture, have been developed by advanced techniques to the present state of the art where Tube Turns has found it possible to produce a finished head forging with all its intricacy using two upsetters and four operations.

The fuel injection housing is a moderate-sized forging with thin sections. But it has its complications owing to the requirement that the register of bosses on the inside with the outside must be held to within 0.010 in. This job is done on a 2700-ton Ajax vertical forging press in a three-station die.

It may be noted at this point that the forge shop contains a large battery of small Clearing presses which are used for trimming and serve the forging presses and upsetters in this function.

(Turn to page 82, please)

You can RECONVERT FITCHBURG GRINDERS



This book shows how to cut grinding costs . . . Sent free . . . write for it today.

With reconversion ahead Fitchburg users should keep in mind all Fitchburg Bowgage Head Precision Grinding Wheelhead Units are standard and interchangeable.

If the grinding operations for which they were purchased are discontinued, the heads can be remounted on standard machines, or on new special bases, for operations other than the ones originally specified. This is particularly appreciated by those using Fitchburg Grinders for ordnance production.

This exclusive Fitchburg feature protects your investment, and we suggest that future buyers of special purpose grinders or plain cylindrical grinders first consult Fitchburg engineers. Write us today.

FITCHBURG GRINDING MACHINE CORP.
FITCHBURG,^{*} MASSACHUSETTS, U. S. A.

Manufacturers of—Bowgage Wheelhead Units, Multiple Precision Grinding Units, Spline Grinders, Cylindrical Grinders, Gear Grinders, Bath Full Universal Grinders and Special Purpose Grinders.

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OUT OUR WAY



T. M. REG. U. S. PAT. OFF.
COPYR. 1944 BY HEA SERVICE, INC.

SPEEDI-DRI is the modern, economical, efficient answer to oil-soaked, slippery floors. White, granular, and oil-thirsty, it is spread by hand and swept up with a stiff brush without shutting down a single machine. Its use eliminates expensive mechanical cleaning equipment, caustics, and dangerous solvents, and greatly reduces the man-hours needed for clean-ups. At the same time, it does a better job.

As soon as it's applied, it provides a non-skid surface. Workmen can move at top speed without fear of slipping. It absorbs oil and grease like a blotter takes ink, even pulling up old deposits in time. **SPEEDI-DRI** is non-combustible and fire retardant. Leading insurance companies recommend its use. There are 101 money-saving applications of **SPEEDI-DRI**. Write your name and address on the margin of this advertisement for complete facts — and FREE SAMPLE!

SUPPLIERS: East — Refiners Lubricating Co., New York 1, New York.
Midwest & South — Waverly Petroleum Products Co., Philadelphia 6, Pa.
West Coast — Waverly Petroleum Products Co., Russ Bldg., San Francisco 4, Calif.

SPEEDI-DRI
OIL AND GREASE ABSORBENT



Bars are cut into suitable billets for forging, on Andrew C. Campbell Cutmatic abrasive cut-off saws. This plant, however, boasts such equipment mounted in conjunction with a long bed capable of accommodating the longest bars.

Thus far we have followed the course of the forging operations. The next stage is the heat treatment, finishing, and inspection prior to shipment to the customers. For this purpose the forgings are transported by conveyor to the heat treating building. Heat treating is handled in a large battery of specially-built furnaces, each one having two parallel sections for increased capacity and for speeding up the operation. Work proceeds in large baskets mounted on conveyors which traverse the furnaces. Following this cycle the work is quenched, then aged in the companion furnaces. The general cycle of events is as follows: pre-heat for four hours, heat treat for six hours, quench, then age for 10 hours.

After heat treatment the forgings are transported to the etching and polishing department concentrated along one side of the building. Here the work is etched by immersion in suitable baths, cooled, then burred and polished on benches. Following this, the forgings are again etched to cover areas exposed by the bench operations. The final stage is 100 per cent inspection for acceptance.

Interesting feature of the department is the linking of all operations by means of a system of Mathews gravity roller conveyors for carrying parts from one station to another.

As in the case of the steel forge, this plant is provided with extensive metallurgical and chemical laboratory facilities for all manner of chemical and physical testing, for production quality control, for research, and troubleshooting. An important feature is the spectrographic laboratory containing two types of spectrographic equipment. The techniques developed here make it possible to use the spectrograph as a means of speeding analysis for production control, eliminating the delays which, in the past, have permitted scrap and ruined heats. Moreover, this technique has gone far to limit the functions of wet chemical analysis.

Latest development is the installation of two industrial X-ray machines—one rated 250 kva, the other 150 kva—which will be employed for the examination of both aluminum and steel forgings and the control and development of techniques in processing.

The pictorial section of this article shows views taken in various interesting departments of the plants mentioned above and should give the reader an impressive view of the entire operation.

*Keep up the flow of letters
to the boys on the front.*

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STRIES



CLARK

For Our Secure Economic Future

GIVE AMERICA HIGHLY SKILLED MEN

Can America meet the ruthless economic challenge of a war-exhausted world?—indeed *she can!*

How?—by creating a nation of highly skilled workers unmatched throughout the world! By teaching to unskilled men the skills that will lift them to better, richer living! By recognizing that unskilled labor adds nothing to a product except cost—and by insuring lowest cost through planned, engineered, mechanized materials handling.

Clark Tructractor is conducting an exhaustive inquiry into the materials handling requirements of post-war industry—in order to design better equipment to meet those requirements. You are invited to participate in that study by sending for a questionnaire concerning the post-war materials handling needs of your business.

CLARK TRUCTRACTOR DIVISION, Battle Creek, Michigan.

TURN PAGE FOR MORE DATA

FORK TRUCK

Fast, sturdy, easy to maneuver in close quarters, Clark Fork Trucks are on the job 24 hours of every day—lifting, moving, tiering, stacking loads of 1000 to 7000 pounds.

CLARKAT

Through busy aisles, and from docks and warehouses, these husky Clarkats haul trailer trains carrying loads 20 times their own weight. Twin front wheels assure stability.

Gas powered.

CLARKTOR-6

At railway terminals and airports, across factory yards, the "Clarktor-6" is ideal equipment—hauling heavily loaded trailers. This all purpose heavy duty tractor with its six-cylinder engine, has a remarkable performance record.

Electric FORK TRUCK

Here is another consistent worker—Clark Fork Truck electric powered. Compact and rugged, with smooth, even power, it handles loads from 1000 to 7000 pounds, saving vital man-hours and money. A better unit at a lower price.

A GUARANTEE OF USEFULNESS

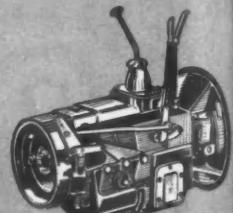
For nearly three decades users of Clark Fork Trucks and Industrial Tractors have been getting the sturdy usefulness and low-cost performance which the name Clark instantly guarantees. Clark engineers are at your service for study of your materials handling problems.

CLARK TRUCTRACTOR

Division of CLARK EQUIPMENT COMPANY • BATTLE CREEK, MICHIGAN
Also BUCHANAN... JACKSON... BERRIEN SPRINGS, MICH.



Some CLARK products



TRANSMISSIONS



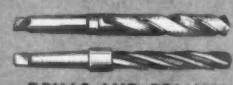
BLIND RIVETING PROCESS



AXLE HOUSINGS



FRONT AND REAR AXLES FOR TRUCKS AND BUSES



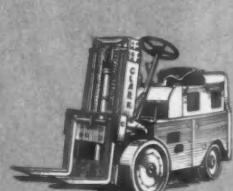
DRILLS AND REAMERS



GEARS AND FORGINGS



ELECTRIC STEEL CASTINGS



INDUSTRIAL TRUCKS AND TRACTORS



RAILWAY CAR TRUCKS



METAL SPOKE WHEELS

New Products

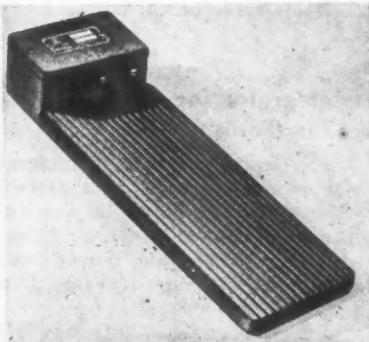
(Continued from page 44)

cobalt is recommended for hogging and heavy-duty cutting on high alloy steels, heat-treated bar stock or forgings. Its red hardness enables it to hold a keen cutting edge at very high temperatures. This grade is used only for solid tool bits. Grade 6 with 20 per cent cobalt is especially recommended for rough turning work, as well as fine finishing at speeds too high or on material too abrasive for H.S.S. Tool Bits. Its red hardness is greater than that of Grade 5. This grade is available in solid tool bits as well as tipped tools.

Both grades of Borcoloy can be ground with ordinary tool room equipment, using a medium fine or fine grain wheel with medium hard bond.

Foot Operated Switch

General Control Company, Boston, Mass., offers a new foot switch for actuating one to eight circuits. Designated the Model "MF," this is said to be the flattest foot switch ever manufactured. The foot rest is only $\frac{1}{2}$ in. above the floor, and it requires only



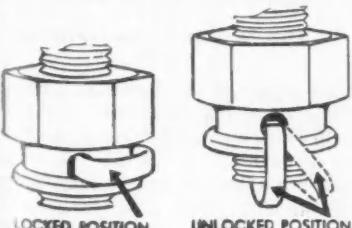
Model "MF" foot switch

1/16 in. throw. This allows the operator to support his whole foot nearly at floor level.

The Model "MF" is constructed to withstand severe use. It is splash and dust proof so that factory conditions cannot affect its life or limit its applications.

Dual Purpose Safety Nut

A dual-purpose safety nut has just been brought out by the Simmons Ma-



Safety nut made by Simmons Machine Tool Corp.

chine Tool Corp., Albany, N. Y. This safety nut operates on the principle of the engagement of a snap ring in one of a number of longitudinal serrations in the bolt thread. With seven serrations on the bolt thread, there are 14 locking positions per revolution of nut. It can be used on any length thread and may be locked or unlocked by a flip of the locking ring.

The serrations in the bolt thread are cut by an internal broaching tool. This

broaching tool is designed for use in close quarters, and may be hand-operated in the case of pre-assembled parts.

Used as a stop nut, the serrations in the bolt thread are not necessary. When the nut is tightened and the locking ring snapped in lock position, the spring pressure provides a stopping action.

Compar Moldings Immune to Oil

Compar washers, seals, gaskets, diaphragms and similar flexible moldings are being turned out for a wide variety of industries by Resistoflex

STROM STEEL BALLS
Now at War - Later in Peace

Strom Metal Balls are now being used in the vehicles of war. But in the peace to come, they will again be dedicated to the designing and building of better methods for air and automotive transportation.

Largest independent and exclusive metal ball manufacturer

Strom STEEL BALL CO.
1850 South 54th Avenue • Cicero, Illinois

Corporation, Belleville, N. J. Though the first moldings of the vinyl derivative were not compounded to take the place of rubber, it has now been demonstrated that compar out-performs rubber in many applications where its use has now become standard. Molded compar is capable of any number of variations which give the exact degree of flexibility, elasticity and abrasion resistance required for each particular application and is widely used in such fields of manufacture as machine tool, radio, automobile, aviation, Diesel engine, X-ray, road-building machinery, air-conditioning and refrigeration.

Two New Firestone Developments

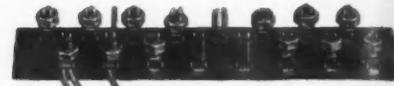
The Firestone Tire and Rubber Co., Akron, Ohio, has developed a plastic moistureproof packaging film which is produced by adding a specially developed moistureproof chemical to Velon, the company's new plastic. The film, which can be transparent or in any color, is said to be a satisfactory substitute for film made with natural rubber.

Another new Firestone development is an adhesive for bonding synthetic rubber to metal. This cement can be

used on metals which formerly had to be brass plated before they could be bonded to synthetic rubber, and on aluminum.

Solderless Wire-to-Wire Connecting Device

The Bee terminal block, a solderless, wire-to-wire connecting device, is a connector strip with practically any desired number of terminal posts—



Bee terminal block

each terminal post capable of handling from two to as many as eight wires in the smaller ranges.

The binding post stud has a slotted channel, the wires being held in this channel between a top clamp or shoe built into the nut, and a lower clamp or shoe which is secured in the base. This arrangement is said to lock every wire to a wire, firmly in position, in a vibration proof and low resistance connection, without danger of loose strands getting away.

These blocks are made by the L. S. Brach Manufacturing Corp., Newark, N. J.

Disintegrator for Broken Tools

The Drafto metal disintegrator, which removes broken tools embedded in dies and work pieces, is a self-contained, portable unit. It operates on any 110-volt, 60-cycle power source. According to the manufacturer, Drafto



In resuming post-war manufacture, no buyer can afford to gamble with inferior sources of supply... Consequently—we urge you NOW to choose "Chicago Screw" as your source for Precision Screw Machine Products.

With our up-to-date production equipment, plus modern inspection tools and methods, backed up by 72 years of experience—we have the "Know How" for producing your toughest jobs.

Under one roof, we have complete facilities for producing the most intricate parts (or the simplest)— $\frac{1}{16}$ " to 5" diameter and any length—from any type of material—in unlimited large or small quantities... Let our mental and physical capacity help make your post-war problems easier!

THE CHICAGO SCREW CO.
ESTABLISHED 1872
1026 SO. HOMAN AVENUE CHICAGO 24, ILL.



Drafto metal disintegrator

Corporation of Cochranton, Pa., any metal can be disintegrated by means of a vibrating arc centering directly over the embedded material. A special coolant assists disintegration, helps to cool the electrodes and prevents heat distortion. The rate of disintegration varies according to the hardness and size of the metal being extracted.

Announcing*

A NEW PRODUCT
BY F. L. JACOBS CO.

AUTOMOBILE CUSHION SPRINGS



For many years the F. L. Jacobs Co. has held an enviable position in the automotive field as one of the leading sources for automobile seat bottom frames and slides. NOW... looking to the future, these facilities are being expanded to include the manufacture of automobile cushion and back coil spring assemblies to your specifications and designs. The qualified members of our engineering and designing departments are now ready to discuss your production plans in this field.

F. L. JACOBS CO.

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DALLAS PLANT, Detroit, Michigan

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SUSPENSION PLANT—LONYO BLVD.

Dearborn, Michigan

MAIN PLANT

1043 SPRUCE STREET, DETROIT 1, MICHIGAN

SUBSIDIARIES:

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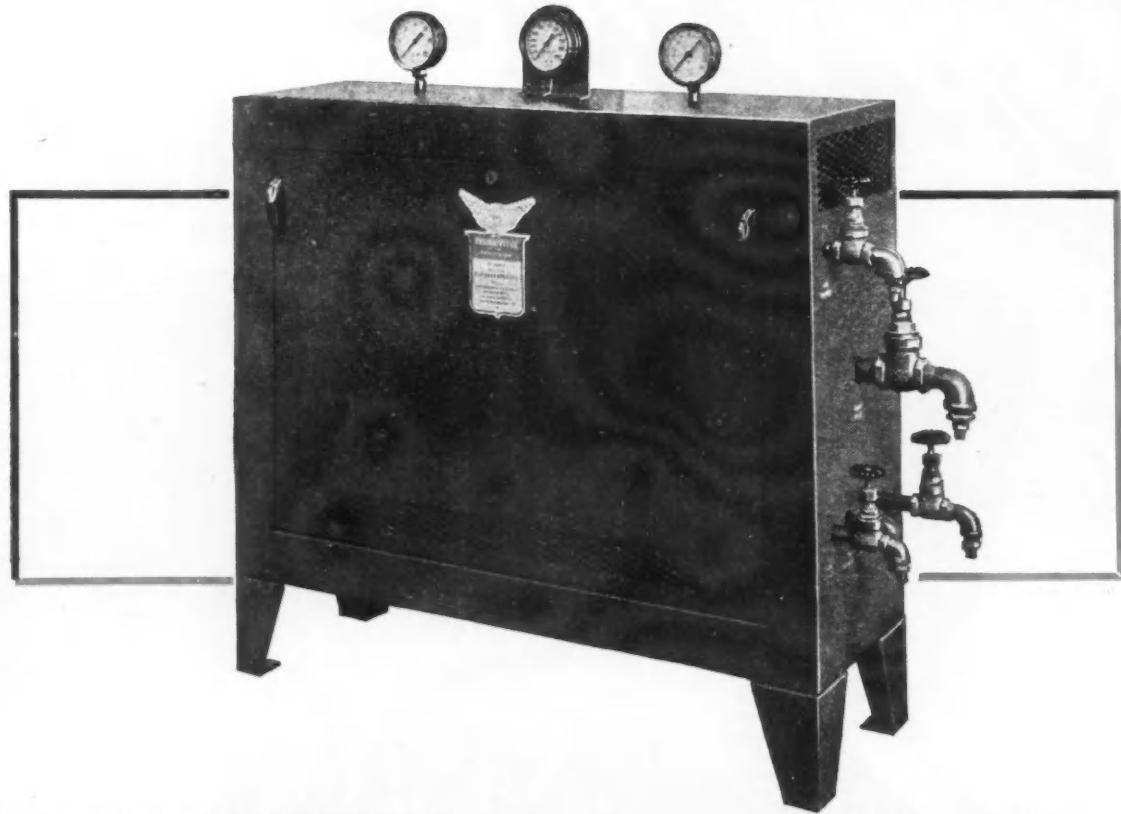
AIR-TRACK MANUFACTURING CORP.

College Park, Maryland

CONTINENTAL DIE CASTING CORP.

Detroit, Michigan

— — — how REDUCTION



THERMOTITE* eliminates need for thinners in aircraft dopes—cuts number of coats by $\frac{2}{3}$!

THERE'S a real revolution going on in aircraft doping procedure. And it is all due to *Thermotite** and Sherwin-Williams P*D*F* (Pre-Doped Fabric). An unbeatable combination for increasing production —because *Thermotite* substitutes heat reduction for thinners.

With *Thermotite**, you can forget the use of thinners entirely. Need for highly critical thinner is eliminated by the modern *Thermotite* Process*.

Because no thinners are used, dopes applied by the *Thermotite* Process* are thinned down, not thinned out. No liquids have "cut" their covering power. Result: They build to six-coat films with three coats...save hours of time and labor as well as volumes of materials!

*Thermotite** is a tested and proved superior method of dope application. It is now in use in many aircraft plants.

Saves Time and Labor!

Never before *Thermotite** have aircraft dopes been applied with such revolutionary speed, efficiency, economy! Valuable savings in time and labor are possible—around 50% when surfaces have not been pre-doped and as much as 66½% in the case of pre-doped fabrics. With lacquer dopes requiring from 30 to 45 minutes drying time for each coat, simple arithmetic shows how many hours of time can be saved per doping job. Furthermore, between-coat sandings are also eliminated—saving still more hours!

Want to know more about *Thermotite**, the new and improved method of dope application? Full details and list of users are yours for the asking. Just get in touch with any Sherwin-Williams technical representative located near you.

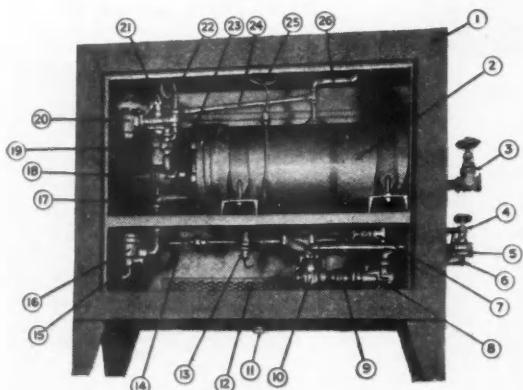
**Thermotite* and P*D*F*—Trade-marks Reg. U. S. Pat. Off.

SHERWIN-WILLIAMS

FOR QUICK ANSWERS TO YOUR WARTIME AERONAUTICAL FINISHING QUESTIONS

ON INCREASES PRODUCTION

Thermotite Unit Interior View



- 1. Metal cabinet
- 2. Heater casing
- 3. Dope intake valve
- 4. Air motor operating valve
- 5. Dope return valve from spray gun
- 6. Dope to spray gun valve
- 7. Pump to heater return valve
- 8. Circulating pump
- 9. Air motor to pump flexible coupling
- 10. Air motor
- 11. Cabinet safety drain pipe
- 12. Cabinet air intake vent
- 13. Temperature gauge bulb
- 14. Paint line to automatic air vent
- 15. Condensate drain line
- 16. Steam trap
- 17. Condensate line to trap
- 18. Thermostat adjusting screw
- 19. Automatic air and vapor release valve
- 20. Steam pressure regulator
- 21. Steam pop safety valve
- 22. Steam loop to pressure gauge
- 23. Thermostat valve
- 24. Air line to automatic vent
- 25. Capillary line to temperature gauge
- 26. Paint pressure gauge line

SHERWIN-WILLIAMS ZINC CHROMATE PRIMER

Superior quality permits 300% reduction—
helps keep production lines moving!

Here's the Zinc Chromate Primer that's *preferred* by America's leading aircraft plants. It's Sherwin-Williams Formula No. 70110, U.S. Government Specification AN-TT-P-656b, developed for better-than-required performance!

Even when thinned out 300%, there's no danger of Sherwin-Williams Zinc Chromate Primer "kicking-out" if used in a properly regulated dip tank... it's the *plus* quality that permits this exceptionally high reduction! And with good tank stability assured, substantial gains in output are possible. Primer goes farther, too, giving greater economy in use.

Dries in 5 Minutes!

Quick drying power also contributes to the time-and-labor-saving features of Sherwin-Williams Zinc Chromate Primer. Only 5 minutes required.

Dependable!

For complete resistance to water, maximum protection against corrosion and high resistance to lacquers at all drying periods—you can depend absolutely upon Sherwin-Williams Zinc Chromate Primer. Its better-than-required specification quality is a positive guarantee of superior performance.

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WRITE FOR DETAILS

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There's no obligation. Address The Sherwin-Williams Company, Cleveland 1, Ohio.



AVIATION FINISHES

WHITE, WIRE, OR PHONE THE SHERWIN-WILLIAMS COMPANY, CLEVELAND 1, OHIO

December 1, 1944

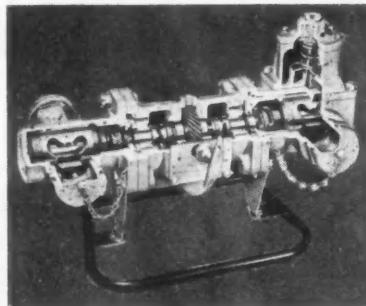
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New Products for Aircraft

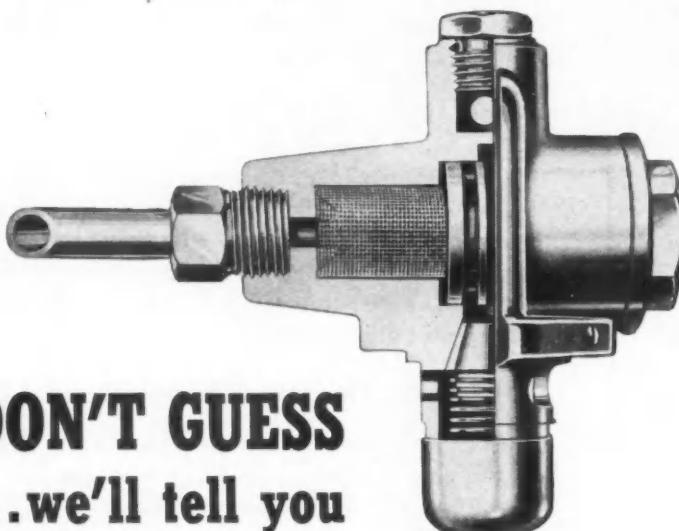
(Continued from page 40)

Portable Bilge and Refueling Unit

The new Romec Model RG-4635-B, made by the Romec Pump Co., Elyria, Ohio, is a two-purpose pumping unit for refueling of aircraft at remote fuel caches or the removal of bilge water from the hull and pontoons of seaplanes. This electrically driven unit comprises two Romec non-pulsating positive displacement rotary pumps, both with off-set rotor, sliding blades,



Romec pumping unit



DON'T GUESS ...we'll tell you

This is a "cut-away" view, actual size, of the VISCO-METER*—6 ounces of precision equipment which, when installed on any engine...gasoline or Diesel...becomes the protector or "watch dog" of engine lubrication. Through a gauge (not shown) the engine operator has

a constant visual report indicating whether or not the engine and all its working parts is being adequately lubricated. VISCO-METER'S*, exclusively, have been rendering this valuable service since 1928. They're available again for peacetime engines.



...and this is a booklet we have prepared to tell every design engineer, manufacturer, distributor, or user of gasoline and Diesel engines the entire story of VISCO-METER*. Write, wire or phone for your copy. If you say so, a VISCO-METER* engineer will deliver it.

VISCO-METER
CORPORATION

BUFFALO 7, N.Y.

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and rocker seals, and a G.E. Motor. The drive end of the motor is equipped with an adapter gearing for both pumps, which are selectively driven—one pump being engaged and the other disengaged, simultaneously, by a hand-operated shift lever.

Special Tool for Installing Shock Rings

A simple means of installing shock rings on Piper Cubs and Taylorcraft is now being produced by LaPointe



Engineering Company, Unionville, Conn. Called the LaPointe shock ring jimmy, the device is a curved steel bar with a swivel head which fits the end of retaining arm on the shock strut.

One end of the bar is slipped through the shock ring, the head on the other end is fitted to the retaining arm, and

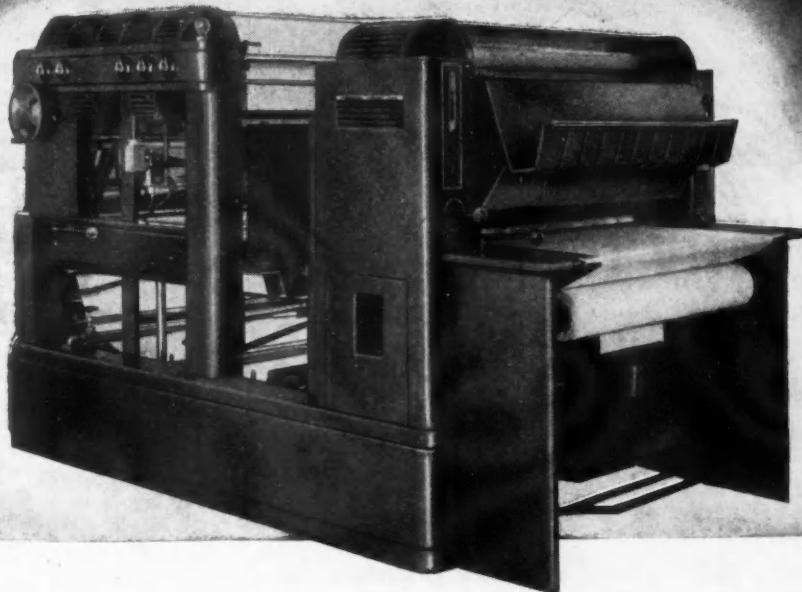
(Turn to page 92, please)

Lightweight, Heavy-Duty Gear Housing of Bakelite



A new development in U.S. Army aircraft is the housing of motor gears for retractable landing lights in a three-piece case of Bakelite high impact-resistant phenolic molding stock. The three sections, two of which contain molded-in metal inserts, are produced by the Plastic Research Laboratories for the Grimes Mfg. Co., Urbana, Ohio.

PUT YOUR RECONVERSION PLANS IN ACTION QUICKLY
WITH LOW COST *Blueprints*



Pease "22-16" Continuous Blueprinting and Processing (Washing, Developing and Drying) Machine has an actual production speed of 20 feet per minute.



RECONVERSION will not be a mere return to prewar production . . . The use of new materials and new methods will increase the demand for high quality Blueprints delivered quickly at low cost.

PEASE BLUEPRINTING MACHINES will provide these necessary Blueprints in volume and on time. Unparalleled in performance, fast and economical in operation, they require less attention and make sharper, clearer, more contrasty prints than any other tracing reproduction machine. Pease Blueprinting Machines are noted for their speed (Pease "22", not illustrated, produces prints at 30 feet per minute or more) and for their low cost, quality production . . . fine prints as low as one cent (or even less) per square foot.

PEASE SENSITIZED PAPERS, for use with any Blueprinting or Whiteprinting (Dry Direct Process) machines, are uniformly dependable for producing quality Blueprints, Blueline Prints, Brownprints (Negatives), Brownline Prints and Multazo Whiteprints.

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THE C. F. PEASE COMPANY
2635 WEST IRVING PARK ROAD • CHICAGO 18, ILLINOIS

Pease Blueprinting Machines for all kinds of Tracing Reproductions

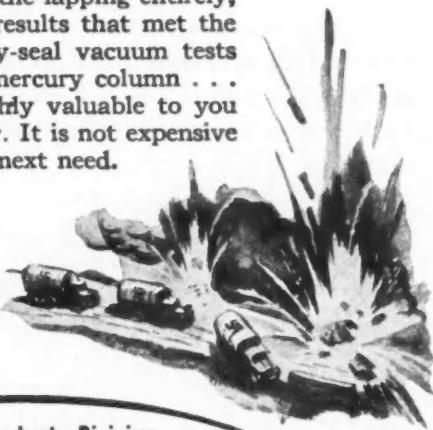


**Here's another example of how
Western skill solved a tricky problem in
aircraft small parts-making**

● It's an airplane carburetor float needle and of course it must work perfectly — nothing less will do. But when it was lapped at assembly with its mating piece, the abrasive action wore a tiny groove at the seating line. Not good in a plane that's miles from its base chopping up Nazi transport — it would have a tendency to stick. But Western engineers worked out an ingenious grinding operation that eliminated thelapping entirely, with smooth finish precision results that met the specification of individual dry-seal vacuum tests — airtight support of a 10" mercury column . . . This kind of skill can be highly valuable to you now, but especially postwar. It is not expensive — get our quotation on your next need.

Western Service is Complete

We manufacture special precision screw machine products to specifications. Machine capacity ranges from $\frac{1}{16}$ " to $4\frac{1}{2}$ " round, with complete equipment for all types of secondary and processing operations, including precision grinding, heat-treating, hardening and penetrating.



Aircraft Products Division

**Western Automatic
Machine Screw Company**

Elyria, Ohio, U. S. A.

Precision Parts and Assemblies Since 1873

then the end of the bar drawn up and over the shock strut. The shock ring slides down the handle, over the head, and into place. Smooth construction of the bar, and special design of the head, are said to prevent cutting, fraying or twisting.

Triptane a Superfuel

(Continued from page 35)

tive supercharged engine with varied amount of supercharge pressure for some fuels. Here the concern is with the upper range of fuels, and iso-octane of 100-octane number is near the bottom of the chart. The power obtained with leaded triptane is nearly three times (performance index numbers) as great as with iso-octane.

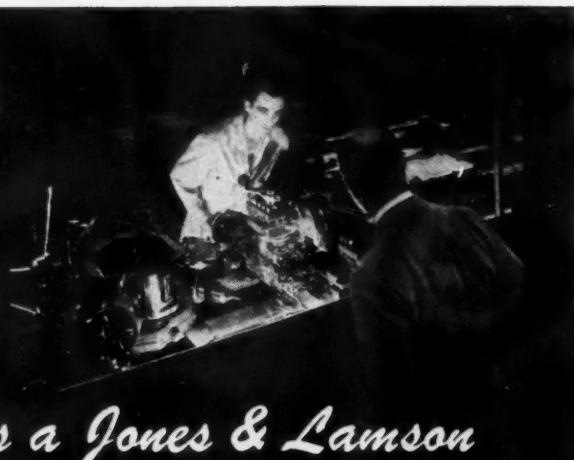
The history of triptane (trimethyl butane) is an interesting one. It was first made as an individual chemical compound by Chavanne, a Belgian, in 1922. It was again made by the Ethyl Gasoline Corp. and first tested in gasoline solution in an engine in 1926, incidental to the molecular structure investigations in the General Motors Research Laboratories, when it was first recognized as being an outstanding fuel component. It has been made by the laboratory methods of the Grignard reaction at various times for engine test.

But triptane suffered from the limitation that it could not then be made cheaply in quantity. About 1939, some 300 gallons of the compound was prepared by the Dow Chemical Co. for the Ethyl Corp. by the rather laborious Grignard laboratory method using metallic magnesium, at a cost of about \$35 a gallon. This amount was made for possible use as a standard fuel; and for the compound trimethyl butane, the coined name "triptane" was suggested by Calingaert. The triptane so produced was subjected to engine tests at various laboratories. It was tested at Wright Field in 1941 in a full-scale aircraft engine, and found to be superior to any other fuel previously tested.

Obviously, in order to have triptane available in quantity at a reasonable price for experimental use in an extensive engine program, it was necessary to have a better method for making it, and in order to evaluate it as a specific fuel component, it was also necessary to have it reasonably pure.

Following a series of researches in the General Motors Laboratories it was found that pure triptane can be made by a relatively simple procedure, the specific character of which cannot be disclosed at this time because of secrecy orders. After progressing through laboratory development and a small-scale pilot plant, a larger-scale pilot plant to make up to 5 or 10 barrels of triptane a day was built. This was done with the approval and assistance of the War Department and the Army Air Forces. It was completed in late 1943, and by January, 1944, had been (Turn to page 96, please)

How many hands does a turret lathe operator need?



— only two ... if it's a Jones & Lamson



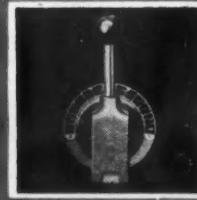
Hindus, for faster-cutting tools have greatly increased the productivity of these machines and the burden upon the operator. The necessity for simplified controls to save waste motion and operator fatigue is, therefore, imperative!

Many a turret lathe operator must have wished, at times, that he were like the six-armed deity of the

Jones & Lamson Universal Turret Lathes are designed not only to take full advantage of the fastest-cutting tools, but also to give every mechanical aid to the operator so that he can operate to the maximum capacity of the machine without undue fatigue.

We show here some of the man-saving, time-saving features built into these machines. Write to us for more detailed information and descriptive literature.

SINGLE LEVER SPINDLE SPEED SELECTOR



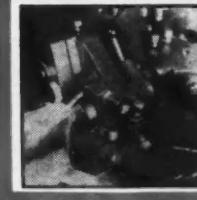
With direct reading dial to control all spindle speeds. Next speed pre-selected while cut is in progress.

SINGLE LEVER FEED SELECTORS



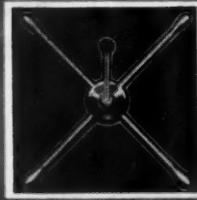
Controlled by single lever, direct reading selector. Feeds pre-selected while cut is in progress.

AUTOMATIC COOLANT SUPPLY TO HEXAGON TURRET



A copious supply of coolant is pumped automatically to the working face of the hexagon turret.

POWER TRAVEL AND INDEXING OF THE HEXAGON TURRET



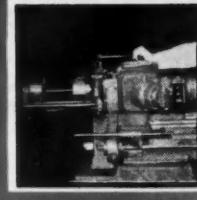
Turret of saddle type machines is power traversed and power indexed. A fine gear and main gear too.

AUTOMATIC LUBRICATION SYSTEM



Requires minimum of attention. Flow of lubricant automatically increases as spindle speed increases.

SIMPLIFIED BAR FEED AND COLLET OPERATING MECHANISM



Operated by a single lever, which opens chuck, feeds in stock and closes chuck.

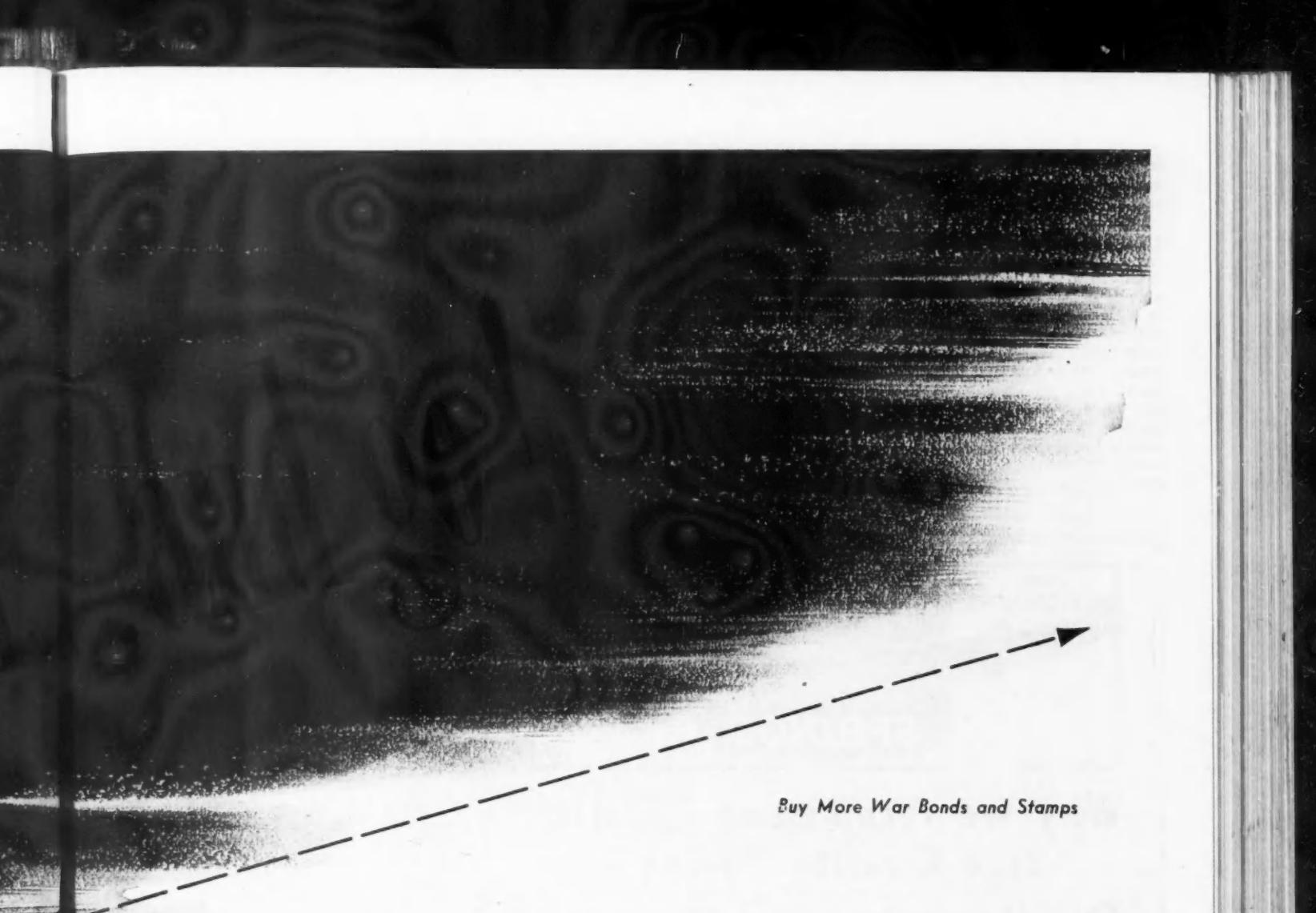
All these features and many others are incorporated as standard in Jones & Lamson Universal Turret Lathes.

JONES & LAMSON
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Springfield, Vermont, U.S.A.



Manufacturers of: Universal Turret Lathes • Fay Automatic Lathes • Automatic Double-End Milling and Centering Machines • Automatic Thread Grinders • Optical Comparators • Automatic Opening Threading Dies and Chasers.





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"Enemy aircraft approaching!" . . . and it's *touch and go* for the flattop fighters! Out where a delay of seconds could sink the ship, Jack & Heintz starters are famous for sure-fire performance. And wherever *touch and go* starting is vital . . . in arctic cold or tropic heat or desert sands . . . these starters are pitting terrific stamina against the toughest battle conditions.

Brush life, for example has gone

up from 500 cycles of operation to 17,000. Operating range is now from 65 below zero to 165 in the sun. Jack and Heintz engineering has cut starter weight in half . . . and boosted starter life far beyond previous records.

These improvements . . . and others like them in the automatic pilot, in flight instruments, generators and retraction motors . . . are traceable to two distinct Jack &

Heintz assets: an engineering staff that begins where usual thinking stops; and manufacturing techniques and revolutionary methods that set completely new standards in precision production.

So valuable in war, this ability . . . these methods hold great new things in store for peacetime aviation. Watch for the fulfillment of their promise.

Jack & Heintz, Inc., Cleveland, Ohio, manufacturers of Aircraft Engine Starters, Generators, Gyro Pilots, Gyro Flight Instruments, Magneto, Motors.



JACK & HEINTZ
Incorporated

in operation producing triptane in somewhat better than expected yields and with a purity of about 99 per cent.

Use of Triptane

On this sample, it is hoped to be able to obtain enough data to evaluate in a thoroughly comprehensive manner the possibilities of triptane as a fuel, both pure and blended with other fuels, and including work on actual flight tests in airplanes. Such tests are under way at Wright Field at Dayton, at the Aircraft Engine Research Laboratory of the National Advisory Committee for Aeronautics in Cleveland, at the Allison Engine Di-

vision of General Motors Corp., and at the General Motors Research Laboratories.

A considerable number of engine tests have already been run in a variety of single-cylinder as well as multi-cylinder engines. They demonstrate the remarkable gains that can be made in the fuel-engine combination. The magnitude of such gains depends upon the particular engine and conditions of operation, and with triptane containing added tetraethyl lead they have amounted to as much as four times the power and to as much as 25 per cent gain in fuel economy over iso-octane or 100-octane gasoline. The gains, under extremely severe engine conditions, may

also be very much less than those mentioned. And this fact again emphasizes the circumstance that the production of power is both a fuel and an engine problem. Fig. 3 shows data obtained on a specific and probably reasonably representative single-cylinder engine in the General Motors Research Laboratories. A 12-cylinder Allison airplane engine has been operated on triptane blends at an output of well over 2500 hp, although the rated take-off horsepower with 100-octane aviation gasoline is about 1500 hp.

Such utilizations of triptane are primarily related to the power development of an engine or how much fuel and air can be burned in the engine. A more fundamental advantage of fuels free from knock such as triptane lies in using them to produce more work per pound of fuel or higher thermodynamic efficiency, as by the use of higher compression ratios.

Studies are under way to evaluate the commercial possibilities of triptane and related compounds, with some preliminary indication that the value of the fuel may justify the present projected cost per gallon, which is relatively high as compared with fuels of lower quality. More importantly, an engine development program is contemplated to see what may be done with engines and their applications to various uses, once the barrier of uncontrolled combustion has been removed to such an important degree. The objective is to find the best combination of engine and fuel to give the greatest value per total dollar, irrespective of what form it may take. This phase of the problem is how to design engines to take advantage of their greater possibilities.

New Name for Celanese Selling Organization

Celanese Corporation of America announces that the name of the selling organization for its plastics products has been changed from Celanese Celluloid Corporation to Celanese Plastics Corporation. This move rounds out the sales organization of the company in the related fields of textiles, plastics and chemicals.

Celanese Celluloid Corporation was formed in 1941 as a sales subsidiary when the original Celluloid Corporation was merged into Celanese Corporation of America as the plastics manufacturing division of the company.

Vinyl Resin Coated Cotton Fabric Aprons

A line of lightweight laboratory and industrial aprons made with high grade cotton fabric and a vinyl resin coating is announced by the B. F. Goodrich Company, Akron, Ohio.

The aprons are said to be particularly well suited for operations in laboratories, battery shops, metal platers and machine shops. The vinyl resin coating makes the aprons waterproof, acid proof, alkali proof, oil and grease resistant.



Why we recommend TUTHILL as a Quality Spring—

QUALITY is its own best argument. It proclaims in service the fact that it embodies the best in *design, materials and workmanship*. It is the thing most desired by user and manufacturer alike—the binding link in service and good-will. Here's why we claim Quality for TUTHILL:

1. **Material control.** Each shipment of steel from which Tuthill Springs are made is inspected to see that it conforms to S. A. E. standards based on chemical analysis.
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3. **Shot blasting.** New conveyor type of Shot-Peening equipment is used to give added strength and longer life to Tuthill Springs.
4. **Experience.** Sixty-four years of constant progress in improved methods and heat treatment insures exceptional performance under all load and service conditions.

TUTHILL not only manufactures a complete line of standard leaf-type springs, but also makes to order special types of springs to meet your specifications. Advise your requirements and let our engineers submit specifications, with recommendations.

Submit your Spring problems with details

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HERO ★★

Soon he'll be home from the wars—triumphantly home . . . to what?

The cold facts are these:

Nearly one-third of our fighting men are returning to "homes" that are without running water . . . 35 per cent of the dwelling units in this country are without sanitary plumbing or bathing facilities of any kind . . . and American slums have bred the highest rate of juvenile crime in our history.

In short, there's still a war to be won here at home!

Our weapons are the mightiest on earth. Our manufacturing productivity is equal to half the world's total capacity . . . our basic economy and our currency

are sound . . . and our faith in the American Ideal is stronger than ever before.

The time to start fighting that war is now. Delay could mean defeat, and the loss of all that our sons have fought and died for. Victory will mean a great new age of peace and prosperity, with jobs and security for all.

The engineers of the basic machine tool producers can help the men of government and of industry to win that victory . . . to plan now the reconversion of our tremendous wealth of resources, skills and machinery to all-out production for a better America.

One of these engineers is a Bryant man. We urge you to call him in today.



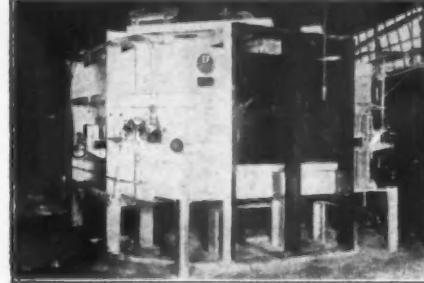
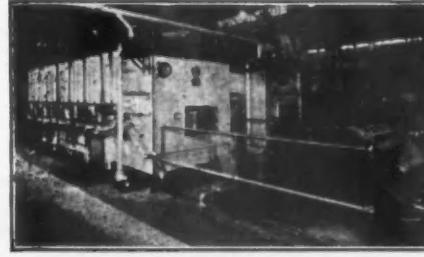
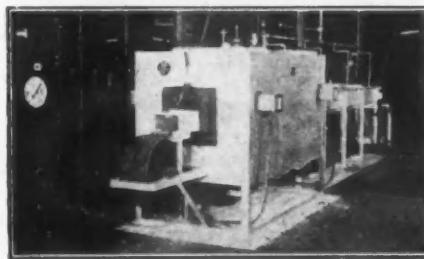
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THE ELECTRIC FURNACE CO.
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Blueprints and Drawings Copied on Microfilm

The use of microphotography for copying blueprints, drawings and plans of all types appears to have a bright postwar industrial future. In addition to the reduced cost of microfilming as compared with blueprint costs, storage and transportation problems are considerably less. The Navy Department has been one of the pioneers in this type of work and microphotography is playing an important part in the work of each of the Navy's bureaus. This development points to application of the art to peacetime industrial practice.

In one of the early stages of its use by the Navy, a Naval officer, leaving Washington by air for duty at Pearl Harbor, tucked a roll of microfilm in each pocket and was off. Three days later the two reels, each containing tiny reproductions of 500 engineering drawings, were at the advance base. Mechanics consulted the film, then made urgently needed repairs to a ship which had been unable to return to action until then. Had they been on paper instead of film, those plans would have weighed 128 lb, obviously too heavy to fit into the officer's pockets and too bulky to go by plane without displacing a passenger of some high priority cargo.

Now, however, film rarely needs to be rushed to the side of a damaged ship or plane. Instead, the plans are ready and waiting when she arrives for repairs, for the Navy is steadily sending to advance bases, tenders, aircraft carriers and repair facilities in general, microfilm copies of the plans of any ships or planes which might require assistance.

Portable projectors or large film readers are supplied to repair facilities receiving microfilm copies of engineering drawings. Larger facilities also receive a microfilm enlarger for making paper prints of any required drawing. Indexes to the film are provided either on the film itself or in booklets packed and distributed with the film.

From available information it appears that the Bureau of Ships has used microphotography to its maximum extent. This Bureau has its own microfilm unit which prepares and indexes the drawings for filming and also distributes the film.

The Bureau supplies plans of every Diesel engine to tenders and the larger Navy yards and advance bases, each of which is equipped with a reader and enlarger. Aboard each ship of mine sweeper or larger class is a complete set of plans of the Diesels installed in each.

Microfilming of machinery and electrical installation plans of ships already in commission and still in active use was begun with destroyers on July 3. About 120,000 copies of machinery indexes now are being distributed to spare part distribution centers, ad-



RUGGED...

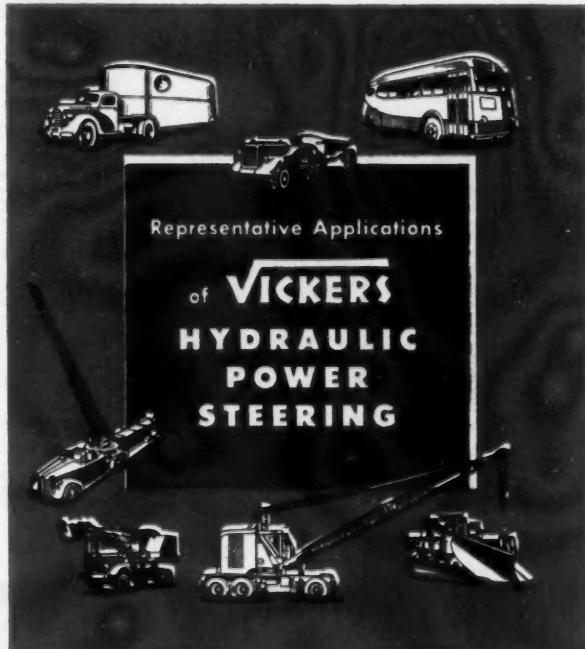
Another Feature of **VICKERS** HYDRAULIC POWER STEERING SYSTEM

Providing effortless, positive, and shockless steering of even the heaviest vehicles, Vickers Hydraulic Power Steering has been in use under the most adverse operating conditions for the last 14 years. The hydraulic system is protected against overload by the relief valve which limits the maximum hydraulic pressure of the system. The pump and booster are thus protected against damage from excessive pressure and the linkage system from abuse. With Vickers Hydraulic Power Steering, road shock thrusts are transmitted to the frame of the vehicle instead of to the steering gear.

Among the many other advantages of Vickers Hydraulic Power Steering are: greater driver efficiency by reducing fatigue to a minimum, easy application to existing chassis designs, wheel "fight" is impossible, greater road safety, and automatic lubrication. Ask for new Bulletin 44-30 for all the facts about the Vickers Hydraulic Power Steering System.

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vance bases and tenders. Blueprints covering complete plans for all new construction are sent from the shipyard to the Bureau of Ships, which makes microfilm copies for distribution to Navy yards and bases. Hull plans for all PT boats, patrol craft and landing craft are now on microfilm. Eventually this will cover all ships. All recent classes of submarines are being supplied with film in either reel or cut form. Cut film is supplied in specially designed cabinets. All alterations also are being sent out periodically on cut film.

The Bureau of Aeronautics has a microfilm unit similar to that of the

Bureau of Ships and sends to overhaul and repair facilities, including aircraft carriers, microfilm copies of drawings for every type of plane. These copies are made in the plant of the contractor.

All carriers are now supplied with microfilmed drawings of the aircraft that are based in them. Some planes require as many as 20,000 plans, all of which can be included in 25 rolls of microfilm. More than 30,000,000 filmed drawings of aircraft have been sent out.

All technical changes now are being microfilmed in the Bureau of Aeronautics as they occur and airmailed every

24 hours to facilities overseas and afloat. A daily average of 5000 pieces of vital technical information is thus being distributed. Microfilming of airplane engines and turrets is now nearing completion.

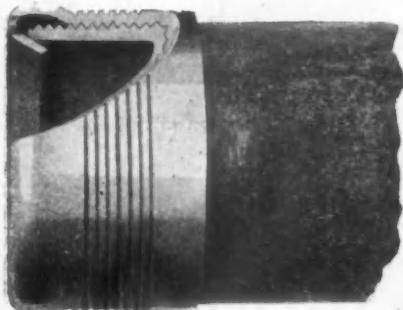
In the Bureau of Ordnance approximately 20,000 torpedo drawings are being microfilmed, copies of which are to be sent to 165 Naval units ashore and afloat. Approximately 6000 aviation Ordnance drawings have been filmed and negotiations are under way to microfilm approximately 700,000 additional Ordnance drawings for similar distribution.

In the Marine Corps plans for all major guns, from the smallest to the largest, have been filmed.

The Navy first tried microfilming for this purpose in 1942 as a means of speeding the return of American submarines to Japanese sea lanes. It has been found that engineering plans on film take up about one per cent of the space required for the same plans on blueprints. Microfilm thus makes it possible for repair facilities, in spite of transportation difficulties and limited storage space, to receive and stow many times the number of plans they could accommodate in blueprint form.



There are many important parts, threaded or not threaded, that can be protected against damage in handling, storing or shipping, with WEDGE Protectors. We specialize in this work, consult us about any unusual or difficult problem of this kind.



Patent No. 2,156,169

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If you weld pipe, in small or large quantities, WEDGE Chill Rings with the patented SPLIT Feature will enable you to do the job FASTER and BETTER. They produce strong reinforced joints—why not investigate?

Briggs Plans for Postwar Expansion

Floor layouts for peacetime automobile body manufacture have been completed or are nearing completion at Briggs Manufacturing Co. and resumption of production is expected to be possible within three months after the Government gives the go-ahead signal. Present peacetime plans of the company call for an eventual expansion of facilities that will provide capacity output 25 per cent above that of pre-war days.

According to company officials, more than \$39 million worth of Government-owned machinery, tools, dies, and fixtures, and another \$39 million worth of Government inventory must be removed from the plants before bodies can be produced in large volume.

War contracts held by Briggs indicate that the 37,800 persons now employed in the company's 11 plants will probably have steady work through next March.

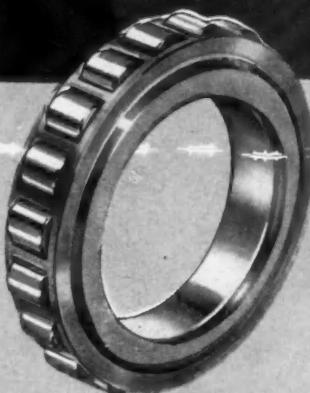
Continental Motors Forms Export Dept.

Continental Motors Corp. has established its own export department to provide first-hand supervision of sales and service of its internal combustion engines. A. S. Bolthouse, assistant manager of the Muskegon Chamber of Commerce for 13 years in charge of trade expansion and industrial promotion, has been named manager of the department. His headquarters will be the general offices of the corporation at Muskegon.



Bearing GOOD WILL

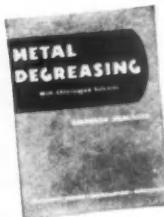
BOWER
ROLLER BEARING CO.
Detroit, Michigan



WHEN IS THE TIME FOR VAPOR DEGREASING?

TODAY is the time for vapor degreasing. *Tomorrow*, too. Because, in utilizing the chemical and physical properties of Trichlorethylene or Perchlorethylene and specially designed equipment for rapid, efficient removal of metal parts, solvent degreasing saves time, saves cost—is an *all-time* tool of industry.

Yes, vapor degreasing has become a *basic part* of production flow lines. It has served to boost war production. And it will serve in peacetime, too, for commercial production of better products faster. It is an important step in good cleaning practice.



"METAL DEGREASING—STANDARD PRACTICES"

This new booklet, prepared by Du Pont in consultation with equipment manufacturers, outlines the fundamentals of safe and efficient operation of vapor degreasing machines. Copies on request.

BE INFLATION WISE! Don't pay more than ceiling prices!
Don't buy on the black market! KEEP PRICES DOWN!



BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY

E. I. DU PONT DE NEMOURS & CO. (INC.)
Electrochemicals Department
Wilmington 98, Delaware

THIS METHOD...

1. **Thoroughly removes grease** and oil from metal parts of any size or shape, usually in a minute or so.
2. **Produces parts clean, warm and dry**—ready for inspection, assembly, further fabrication or finishing of any type.
3. **Minimizes finishing rejects** because solvent reaches and removes grease and oil from deep draws, holes and places which are almost inaccessible.
4. **Reduces risk** of damage to delicate parts.
5. **Can be used alone** or as a part of a process flow line.
6. **Utilizes compact equipment** that fits into small space.
7. **Consumes only small quantities** of solvent. Contaminated solvent is recovered economically for re-use.
8. **Uses** the absolutely pure vapors of a non-flammable solvent as a cleaning medium.
9. **Simplifies** cleaning procedure, is easy to operate as a process.
10. **Saves time and cost**—in its own operation, and in the subsequent handling and finishing of parts.

***Vapor degreasing is basic for good metal cleaning.** For each job there is a suitable cycle or combination of treatments. In every case, the final rinse in pure, uncontaminated solvent vapor assures positive removal of the last traces of grease and oil.

Design of Hat-Type Plate Stringer Combinations

(Continued from page 32)

these generally are less efficient than rectangular stringers. A slight slope, such as that required for rolling, is inconsequential.

Advantage has been taken of the similitude characteristics of the computation procedure to limit the calculations to stringers of 2-in. depth. By plotting the results of the computations in a dimensionless form, the design charts are made applicable to stringers of all depths. This explains the appearance of the dimension t (t = plate thickness, a known dimension) in the parameters of the charts.

The procedure employed was to design a number of plate stringer combinations to conform to Equation (2). These combinations were grouped in sets of six, each set having the six basic stringers (i.e., the stringers of Fig. 1 with $W_s = 1\frac{1}{2}$ and $t_s = 0.040, 0.060, 0.080, 0.120, 0.140, 0.160$), and constant t and t_s . Thus, six points on a curve were determined. Additional points were computed where needed.

Computations were made in the following order:

- (a) b from Equation (1);
- (b) ρ from b , t , and stringer section properties;
- (c) L/\sqrt{C} from Equation (2);
- (d) P by the method of Ref. 1;
- (e) $L/(t\sqrt{C})$, $P/(bt)$, and t/t_s .

Hence, the quantities $P/(bt)$ and t/t_s were plotted against $L/(t\sqrt{C})$. The results plotted in this way are valid for stringers of any depth. The dotted lines on the charts indicate estimated limits of design proportions; that is to say, regions outside of these lines are considered to be of no practical interest because of abnormal stringer spacings, excessive t/t_s ratios, unusual slenderness ratios, etc. In particular, the diagonal cut-off lines extending from the upper left to the lower right are determined by minimum allowable stringer spacings. Stringer spacings increase with the distances inside of these lines.

V—Application of Design Charts

Since the results of Art. II show that zero skin gage is generally the most efficient condition, the selection of the skin is not a structural problem, except in designing for shear strength. Aside from this, the choice of the skin thickness must depend on shop requirements, aerodynamic considerations, etc. Accordingly, in the application of the charts, the skin gage is left to the discretion of the designer. Likewise, since bulkhead spacings are determined by various design requirements and weight compromises, the length L is considered to be an independent variable.

For most applications of the charts, the design load per inch, P/b , is ap-

proximately fixed by wing bending moments. The method of using the charts in this case to obtain the optimum plate stringer proportions is best illustrated by an example:

Example

$t = 0.091$ in. $L = 35$ in. $C = 1.5$
 $P/b = 8000$ lb/in. Material, 24S Alclad
Stringer compression yield stress =
64,000 psi

Plate compression yield stress = 57,000
psi

Determine the minimum equivalent gage and the corresponding plate stringer dimensions, using the best standard stringer available.

Solution

From the given conditions,

$$L/(t\sqrt{C}) = 314 \text{ and } P/(bt) = 88000.$$

These two values fix a point on each of the 64,000-57,000 design charts. On some of the charts, these points lie outside of the limiting lines, and such



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charts are disregarded. The smallest H_s/t ratio which gives admissible dimensions is $H_s/t = 20$, and the corresponding curve parameter is $t_s/t = 2.07$. The ratio $H_s/t = 22$ gives a slightly heavier plate-stringer combination ($t_s/t = 2.14$), but it results in a stringer of standard depth. Accordingly, the ratio $H_s/t = 22$ is adopted. Then $H_s = 2$ in. and $t_s = 0.194$ in.; i.e., the weight of the plate stringer combination is equivalent to a flat plate of thickness 0.194 in.

By using the chart $H_s/t = 22$, the abscissa $L/(t \sqrt{C}) = 314$, and the parameter $t_s/t = 2.14$, one obtains from the stringer-gage curves $t/t_s = 1.15$.

Hence $t_s = 0.079$ in. The best standard gage t_s is then 0.081 in. To conform to the above dimensions, the following values are selected from a standards book:

$$H_s = 2, \quad W_s = 1\frac{1}{2}, \quad t_s = 0.081, \\ A_s = 0.553, \quad p_s = 0.746$$

Then, from Equation (1), $b = 5\frac{1}{2}$ in. Thus, the plate-stringer combination is completely designed.

For a check, the value of P/b corresponding to the above dimensions is computed by the method of Ref. 1, and is found to be 8270 lb/in. Since this is somewhat higher than the design value 8000 lb/in., the stringer spacing

may be increased slightly, say to $5\frac{1}{2}$ in.

In some cases it may be desired to use the charts in other ways, as for example, to determine the load per chordwise inch which is permissible with a given reduced length L/\sqrt{C} , a given equivalent gage t_s , and a given sheet gage t . However, no essential difference in the use of the charts results from the choice of the independent variables. It is clear that the charts may be used to study the effect of various skin gages and bulkhead spacings. The curves of the charts should not be confused with ordinary column curves, since t_s and b vary on any given curve.

Production of M-29C Amphibious Cargo Carrier

(Continued from page 39)

tachments, the vehicle is again tested in water—this time in a large bath in the yard. Here it is run under full power while tied up, again with inspectors swarming about the hull on the lookout for possible leaks.

To touch briefly upon the mechanical details of the Weasel, it may be noted that the Champion engine is mounted in front, conventionally, with a propeller shaft drive to the differential at the rear. The driving axle is of two-speed type with a small auxiliary lever for shifting. In combination with the standard transmission this arrangement offers a selection of six speed changes, forward, and two reverse. Steering is by differential brakes for each track.

This brief commentary on the production of the Weasel has been confined deliberately to the fabrication of the hull and final assembly, inasmuch as some of the mechanical units, particularly the powerplant, are well known and were described in these pages some years ago. A sampling of interesting views in the body shop and on the assembly line, reproduced here, will give our readers an excellent visualization of how the job is done at Studebaker.

Pontiac Assembling 37-Passenger Buses

Following conversion of the Pontiac final assembly line, Pontiac Motor Div. of General Motors Corp. is completely assembling large 37-passenger "parlor-coach" buses urgently needed to keep the hard-pressed interurban transportation system operating. The buses are being assembled for the G.M. Truck and Coach Division. Two floors of the Pontiac assembly plant are required for the job, with fronts, backs, and tops assembled on the second floor and lowered to the first floor where they are joined with side and body assemblies. The buses, 35 ft long and with all-metal body construction, are powered by G.M.C. six-cylinder 153 1/2-hp engines.



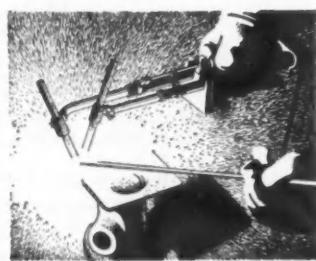
New 9000° Arc Torch Can Be Used for Welding and Brazing All Ferrous and Non-Ferrous Metals and Alloys

Now an arc torch that makes it possible to do most jobs *electrically* that previously were thought possible only with gas. This attachment for arc welders provides an independent source of heat by means of two carbons. It is capable of producing intense heat, approximately 9000° F., over 2000° hotter than an oxyacetylene flame. Pure heat, no oxygen or gas to contaminate the weld. No pressure to force the molten metal away or blow holes in light sections.

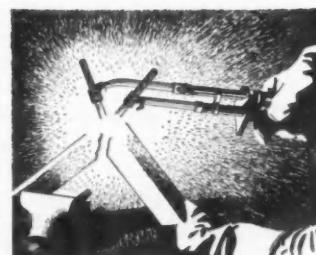
Developed to capitalize to the fullest on the time-saving advantages of electric welding, the new Mid-States 9000° arc torch can be used with any AC or DC electric welder. It opens up new horizons of service in this field, never before possible with an electrically operated instrument.

New uses are being found every day for products that have been familiar to us for years. Wrigley's Spearmint Gum, always enjoyed for its chewing satisfaction, is now proving with the fighting men overseas many benefits which will be useful to you in peacetime. One of the big factors in mass production is the alertness and efficiency of the man on the job. The chewing of Wrigley's Spearmint will help keep you alert and wide-awake during those work periods that, while seemingly dull and monotonous, call for watchfulness in order to get perfection in the final assembly.

You can get complete information from Mid-States Equipment Co., 2429 S. Michigan Avenue, Chicago 16, Illinois.



For BRAZING Steel, Cast Iron, Malleable Iron, Copper, Brass, Bronze, and other ferrous and non-ferrous metals.



For HEATING to Straighten or Bend, etc.

V-168

It's Houdry and TCC that are setting the records!

First in Volume—Houdry and TCC units represent nearly two-thirds of the world's total* catalytic cracking capacity and have supplied all but a minor percentage of the United Nations entire war requirements of catalytic aviation fuel.

First in Quality—The highest-octane catalytic cracked aviation base stock being produced anywhere in the world in one pass comes from Houdry-licensed plants.

Houdry licensees will enter the post-war competition for motor fuel markets well armed. The proved efficiency of their processes is enhanced by the sustained engineering support of Houdry Laboratories, which make available improved operating techniques as well as pilot-plant evaluation of crude stocks to assure maximum yields.

* Includes capacity now serving the war program by improving aviation fuel quality through retreating.

HOUDRY PROCESS CORPORATION WILMINGTON, DELAWARE

Houdry Catalytic Processes and the TCC Process are available through the following licensing agents to all American refiners, subject to approval by the United States Government.

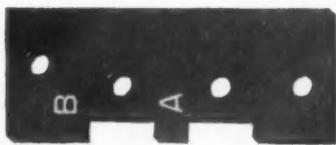
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New York City, New York

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Boston, Massachusetts

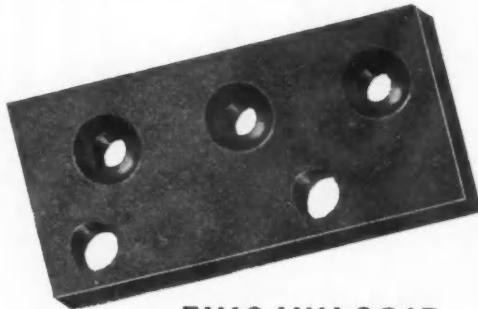


VITAL CONTROLS ARE C-D INSULATED



THIS DILECTO

part is used to identify connections as well as to mount and to insulate them. Good mechanical and electrical properties are needed.



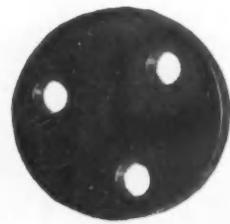
THIS VULCOID

part must resist carbon deposit from arcs as well as prove equal to mechanical shock and also retain its electrical insulating properties under adverse conditions.



THIS CELORON

part had to be of a material that could be molded to shape, that was a good insulator and strong.



THIS DILECTENE

part must remain stable over a wide range of frequencies and in spite of humidity conditions.



CONTINENTAL-DIAMOND manufactures Electrical Insulating Materials that are engineered to meet specific electrical, as well as mechanical and thermal conditions. That's why C-D products are used in all types of Military Equipment where possibility of failure must be reduced to a minimum.

WHAT MATERIAL?

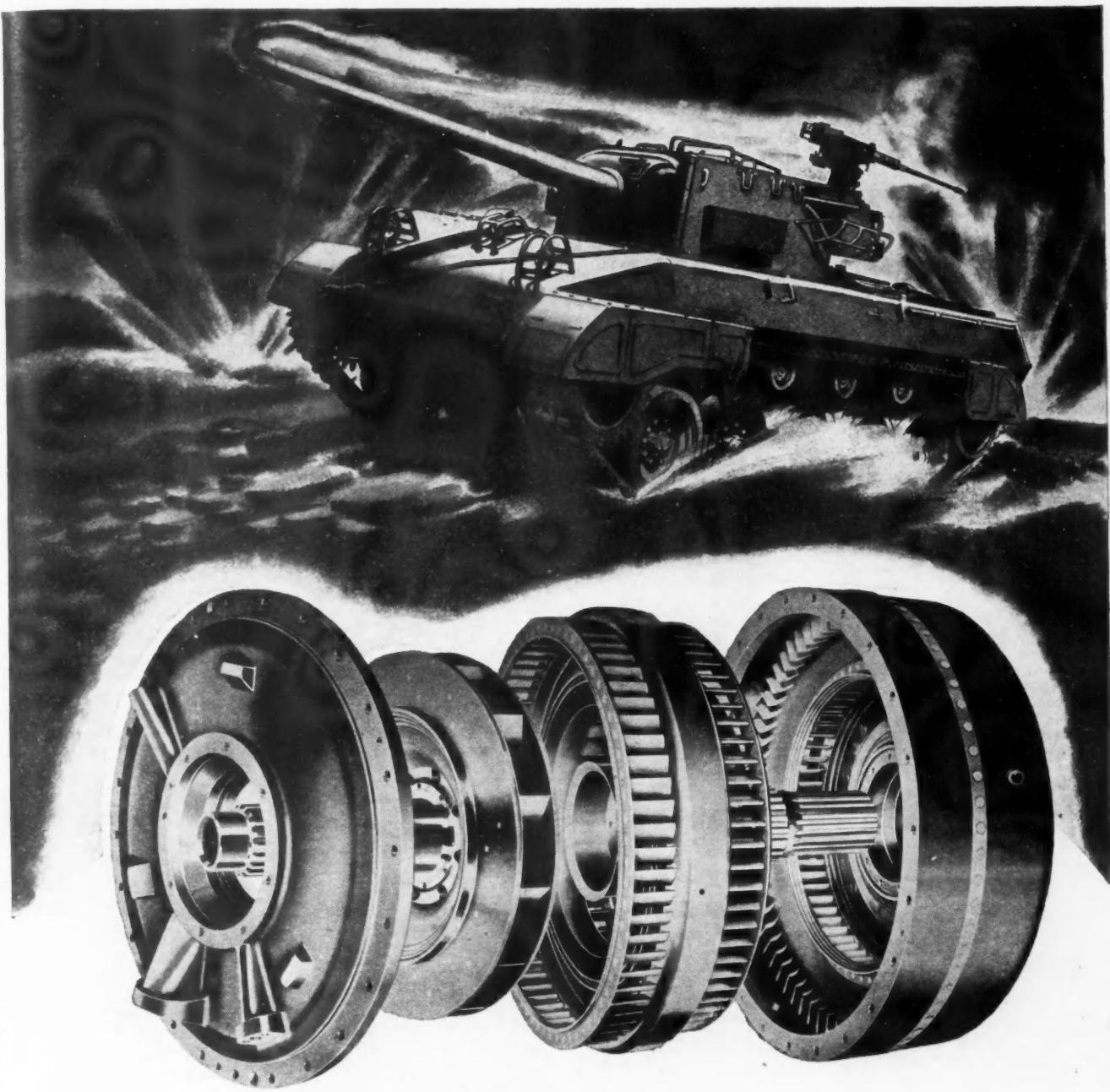
C-D technicians will be glad to help you answer this problem. Send for bulletin GF.

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Continental - Diamond FIBRE COMPANY

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The amazing "Hell-Cat" Tank Destroyer...

Equipped with Spicer Torque Converter

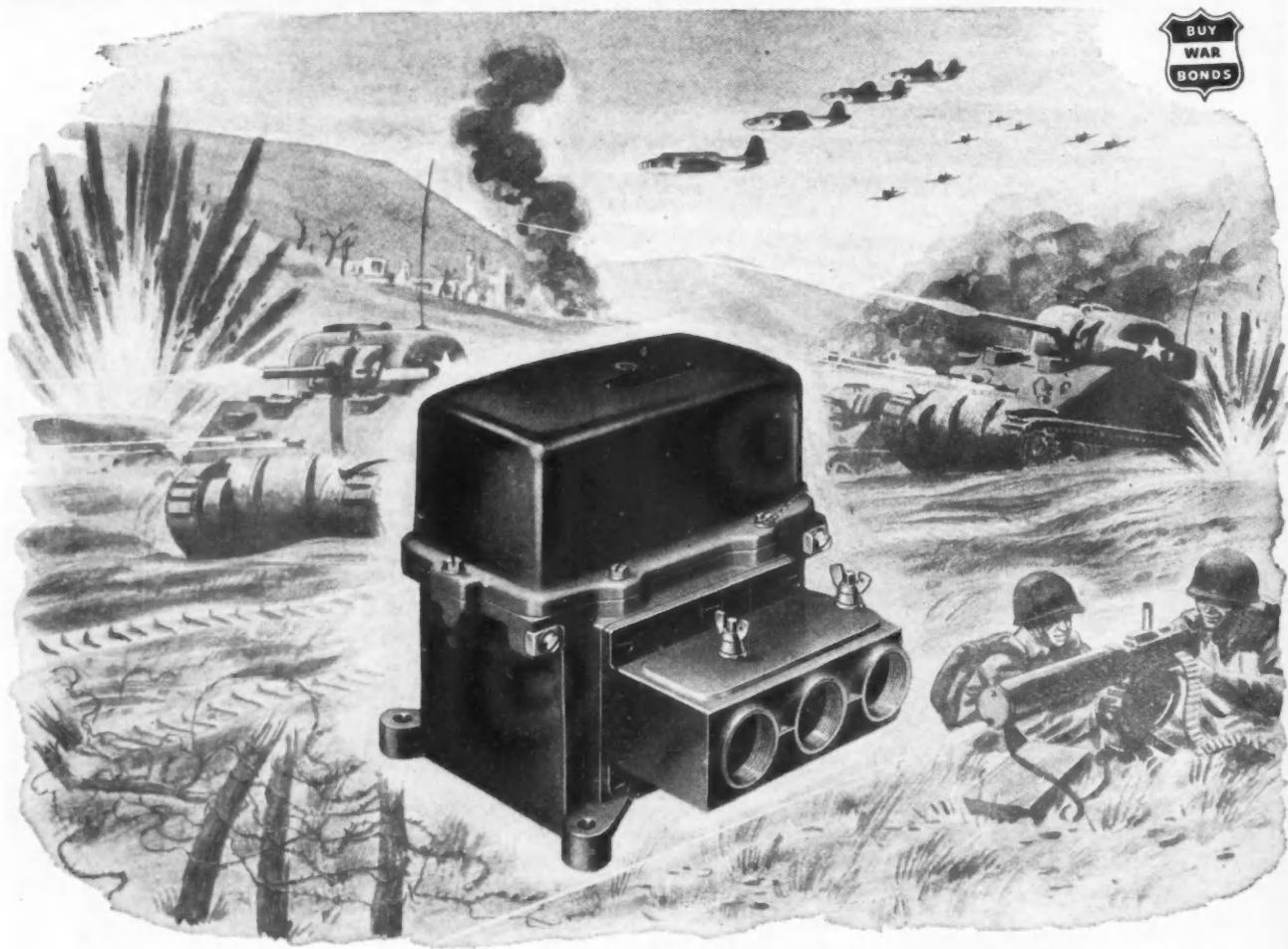
Capable of speeds up to 55 miles per hour, this Tank Destroyer mounts a high velocity 76 MM cannon that can effectively knock out enemy tanks at several thousand yards. Its superior performance enables it to out-maneuver, out-speed and out-shoot the most formidable enemy equipment... at the same time making it the most elusive target in modern tank warfare. Many of these advantages are secured with the help of the revolutionary Spicer Torque Converter. It has been in service in the M-18 Tank Destroyer for over a year, and will again be ready for civilian carrier and transport use when peacetime production starts. Spicer Manufacturing Corporation, Toledo, Ohio.

Spicer Corporation is the sole licensee for the production of this torque converter for Busses and Trucks under Lysholm-Smith patents.



BROWN-LIP CLUTCHES AND TRANSMISSIONS • SALISBURY FRONT AND REAR AXLES

SPICER UNIVERSAL JOINTS • PARISH FRAMES, STAMPINGS



Improved 3 ways for Battlefield Reception...



In this war of movement, when battle orders usually travel by radio, any interference in reception can be dangerous, disastrous!

Early in the war, one serious source of radio interference came from the tank generators and their control units. This interference has now been successfully eliminated by the develop-

ment of an improved control unit by Auto-Lite. Actually, the control unit gives improved reception in three ways: Eliminates radio interference, operates submerged or dry, ups life over 100%.

Advanced engineering achievements such as this again explains why on battlefronts and the homefront the name Auto-Lite means precision manufacturing.

THE ELECTRIC AUTO-LITE COMPANY

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AUTO-LITE

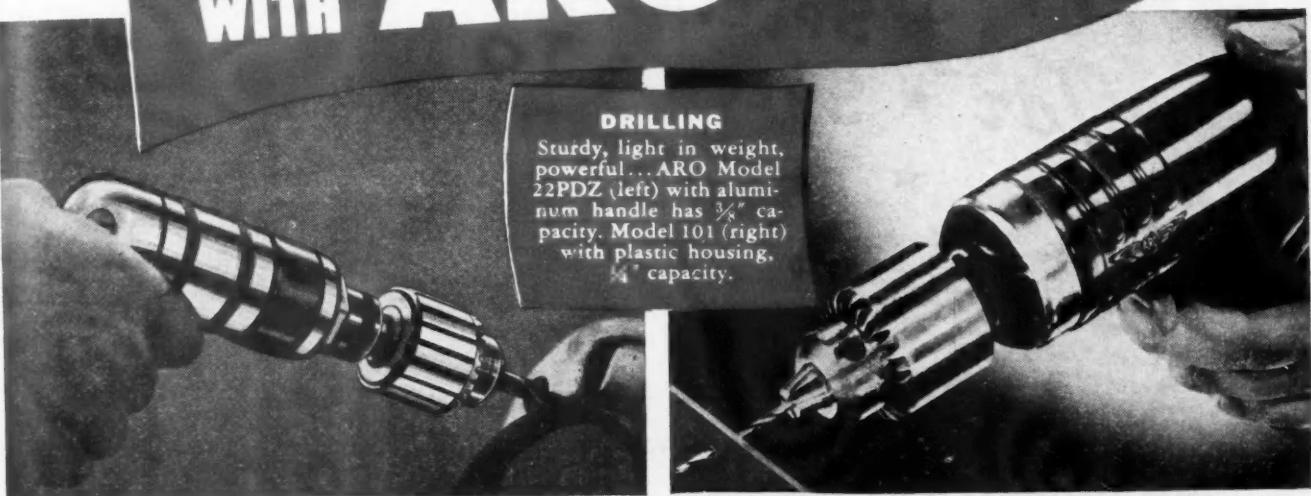
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LIGHTING • IGNITION
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TUNE IN "EVERYTHING FOR THE BOYS"—STARRING DICK HAYMES—EVERY TUESDAY NIGHT—NBC NETWORK

DO IT better and faster
WITH ARO PNEUMATIC TOOLS

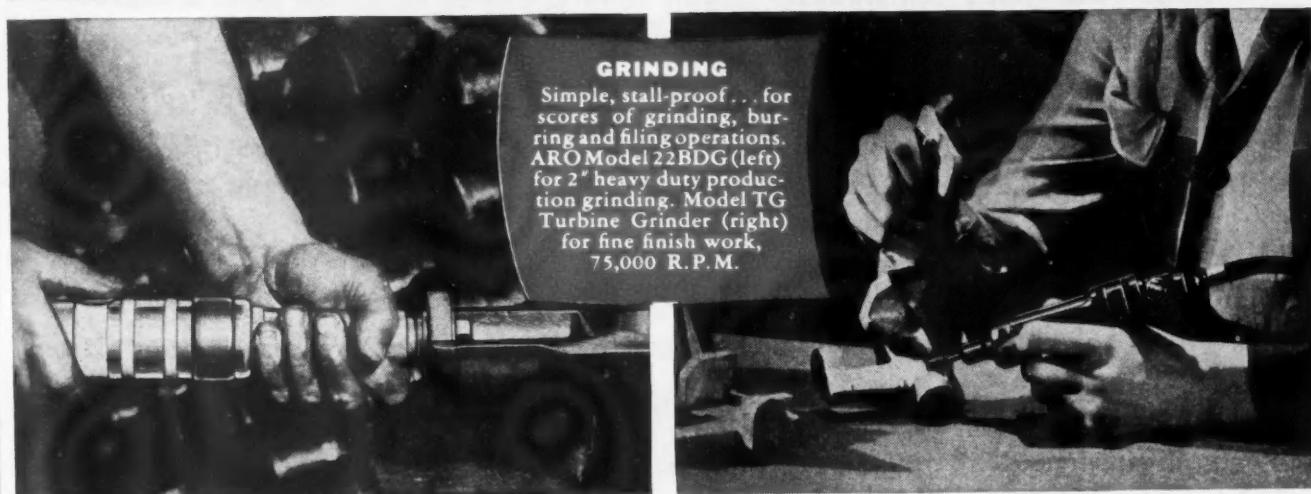
DRILLING

Sturdy, light in weight, powerful... ARO Model 22PDZ (left) with aluminum handle has $\frac{3}{8}$ " capacity. Model 101 (right) with plastic housing, $\frac{1}{4}$ " capacity.



GRINDING

Simple, stall-proof... for scores of grinding, burring and filing operations. ARO Model 22BDG (left) for 2" heavy duty production grinding. Model TG Turbine Grinder (right) for fine finish work, 75,000 R.P.M.



New! **IMPACT TOOLS**
 ARO TORQUE CONTROL... with new simple impact mechanism... eliminates stretching, stripping or "burning" in nut setting or screw driving. Model 106 (left), $\frac{1}{4}$ " capacity, reversible. Model 131 (right), $\frac{1}{4}$ " to $\frac{3}{8}$ " capacity, reversible.



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 BRYAN, OHIO**

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★ SPECIAL TOOLS
★ SPECIAL PARTS

AS designers and builders of special machinery, special tools, and special parts FENN brings you the accumulated experience of *three generations* continuously engaged in precision machine shop work.

FENN will handle the entire job from blue prints straight through to the finished machine, tool, or part; or take your idea, develop it, and build a machine that will do what you expect of it.

FENN'S long experience on the shop floor and their knowledge gained in solving many difficult mechanical problems give them an individual approach to every problem. For FENN definitely expects to add that something to the finished machine that will pay dividends in faster, smoother, more dependable operation.

IT costs nothing to consult with FENN and no obligation is incurred until you are certain that they can contribute tangible, measurable value to your machinery problems. Your inquiries will have careful and prompt attention.

THE FENN MANUFACTURING COMPANY

Hartford, Connecticut

Builders of Better Machinery To Meet New Demands

For that "Touch of Tomorrow" on Postwar Models . . .

Plexiglas



• Edge-lighted dials of transparent PLEXIGLAS are among scores of automotive applications. Size, shape, color, lettering and marking can be designed to harmonize with the interior styling.



• New styling where it's quick to catch the customer's eye. Colorful horn buttons of PLEXIGLAS with three-dimensional designs are another adaptation of "aviation's standard transparent plastic."

• From radiator ornament to rear light nameplate, PLEXIGLAS will put sparkle in postwar models. So permanent is this transparent plastic it may be used to embellish exteriors as well as interiors.

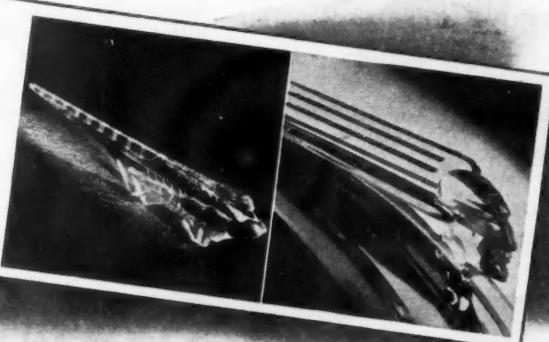
• To add that "touch of tomorrow" to postwar models, take advantage of the crystal clarity and brilliant lustre of PLEXIGLAS. This transparent plastic adapts itself to scores of applications including horn buttons, radiator ornaments, radio grilles, instrument and clock dials, escutcheons and body hardware.

Numerous prewar uses of PLEXIGLAS in motor cars proved the permanence of its transparency, which has been conclusively confirmed by three years of combat service on every type of Army and Navy plane.

The motor car industry already knows from experience how easily PLEXIGLAS can be molded in mass-production. Postwar models will offer many opportunities to use its gem-like beauty, its ability to pipe light and its adaptability to three-dimensional effects. *Specify PLEXIGLAS moldings on your blueprints.*

For additional information, telephone or write to our Detroit Representative: W. E. Biggers—619 Fisher Building—Madison 1500.

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PLEXIGLAS is the trade-mark, Reg. U.S. Pat. Off., for the acrylic resin thermoplastic sheets, rods and molding powders manufactured by Rohm & Haas Company

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What is Your A.Q.?



Here's a Challenge!*

Try your hand at this brief Grinding Wheel QUIZ and find out your A.Q. (Abrasive Quotient).

Grinding Wheel Quiz

- * Question 1. Why is the modern grinding wheel partially responsible for today's high standard of living?
- Question 2. May grinding wheels be identified by their color?
- Question 3. How does a grinding wheel sharpen itself as it works?
- Question 4. What is the weight of a vitrified aluminum oxide wheel measuring 8" in diameter by 2½" thick?
- Question 5. What is Green Electrolon?
- Question 6. How are standard abrasive grain sizes determined?

Answers



These and many other interesting facts are to be found in Abrasive Company's 120-page Grinding Wheel Data Book. It's handy, authentic, illustrated!

It's also
YOURS
FREE upon request, while the supply holds out.



1. Because, as a cutting tool, the grinding wheel has made possible much low-cost mass production of mechanical parts.
2. Yes. For example, Abrasive Company's Borolon Vitrified wheels in "K," Bond are blue. SB Borolon Vitrified wheels tool and cutter grinding are red.
3. The grains on the wheel's surface are broken or pulled out under stress of work as they become dull, thus continually presenting new, sharp cutting points.
4. Eleven pounds—as shown in the table on page 106 of the Abrasive Company Grinding Wheel Data Book.
5. Green Electrolon is a special type of silicon carbide suitable for grinding materials of exceptional hardness, such as tungsten and tantalum carbide.
6. By the number of openings per linear inch in the screens or sieves through which the abrasive grain is passed.

If you answered more than 3 you're not only very good, but you must have been reading Abrasive Company's Grinding Wheel Data Book!

COMMANDING QUALITY . . . OUTSTANDING RESULTS



ABRASIVE COMPANY

DIVISION OF SIMONDS SAW AND STEEL CO.

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The Howell Protected Type Motor, shown, gives complete protection against dripping liquids, metal chips and other falling particles. Completely streamlined—utilizing non-breakable steel frame—malleable or steel base—cast iron end plates and cast iron, weatherproof terminal box are standard construction features. Special horizontal and vertical mountings are available.

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The tens of thousands of owners who already have Howell Motors are "walking on air." Producers do like quality.

But, we all know the entire electric motor industry is confronted with a serious situation today. Demands for motors are up. Manpower is short. Materials are scarce.

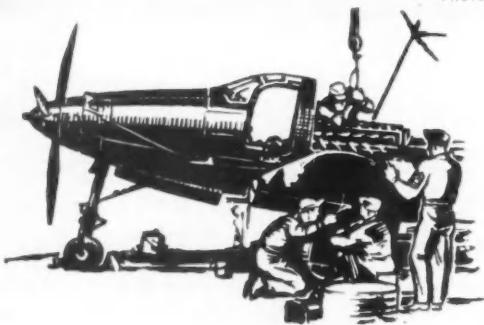
While we are swamped with orders for Howell Motors, we have flatly refused to skimp on quality in order to speed production. However, we fully recognize our obligation to put forth the maximum effort in serving our customers NOW! This, we are doing.

Buy Horsepower by
HOWELL ELECTRIC-MOTORS COMPANY
HOWELL, MICHIGAN

Manufacturers of Quality Motors Since 1915



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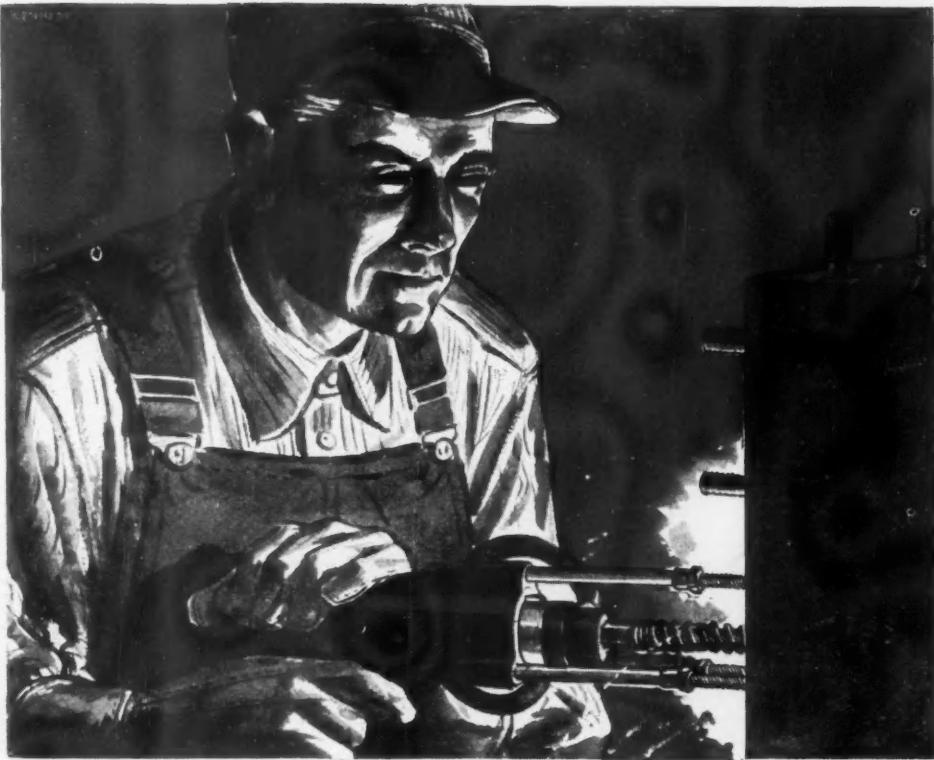
You never hear of him, much less see him . . . He is seldom decorated . . . Yet he and his men keep our heavy bombers, our mediums and our fighters in the air . . . He's the Line Chief.

STAINING up narrow mountain ledges hewn by American bulldozers through rock and shale . . . Down into mucky bogs, reeking with mud and blood . . . Across shifting, treacherous, blistering desert sands, hotter than the hubs of hell . . . Speeding over roads built by the Romans, tried through the centuries . . . Wheels. Thousands of them . . . Erie Wheels bearing supplies, munitions and men . . . ordnance, food, ambulances . . . Wheels rolling the American Armed Forces toward victory . . . We salute all makers of wheels, for together we bear the loads that translate the Four Freedoms and the Bill of Rights to action.

Erie Wheels

ERIE MALLEABLE IRON CO.

ERIE, PENNSYLVANIA



Complete fusion of stud to metal in less than 1/2 second...

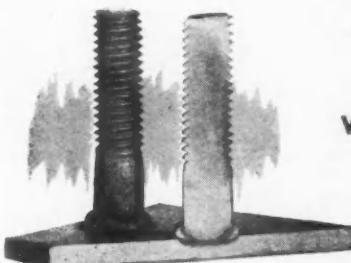
The **Nelson Stud Welder** is simple to operate because the welding is automatically controlled. It eliminates the need for drilling, tapping, and hand welding bolts to secure parts, because it end-welds studs directly to the metal surface.

It is used by more than 460 industrial plants and shipyards. Operators are securing 500 to 1500 studs a shift. No previous welding experience is necessary to operate it.

Complete fusion of the stud to metal is obtained by accurate arc timing control, automatic action of the "gun," the use of flux-filled studs, and complete shielding of the arc.

For complete data, catalog and price list, write:

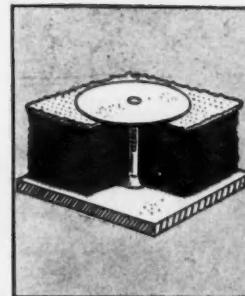
**NELSON SPECIALTY
WELDING EQUIPMENT CORPORATION**
Dept. AV, 440 Peralta Avenue
San Leandro, California



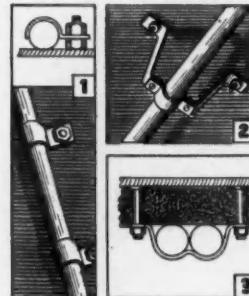
Cutaway view of stud,
after etching with Nital.

Eastern Representative: Camden Stud Welding Corp.
Dept. 22, 1416 South Sixth St., Camden, N. J.

TYPICAL STUD APPLICATIONS



Nelson Insulation Pins are used to secure soft insulation rapidly and economically. They are welded directly through the material without injury to it. Where large metal surfaces must be insulated these pins will save both time and material.



Wiring, conduit, and pipe are quickly secured. Here illustrated are a few methods: 1. Securing conduit. 2. Securing pipe (single and multiple runs). 3. Securing wiring of all kinds over soft insulation material.



General Maintenance - The Nelson Stud Welder is excellent for all types of small repair work. It can be used anywhere there is need to endweld studs to metal. For securing oil lines; for covers; hooks; air lines; machinery installations; and repairs.

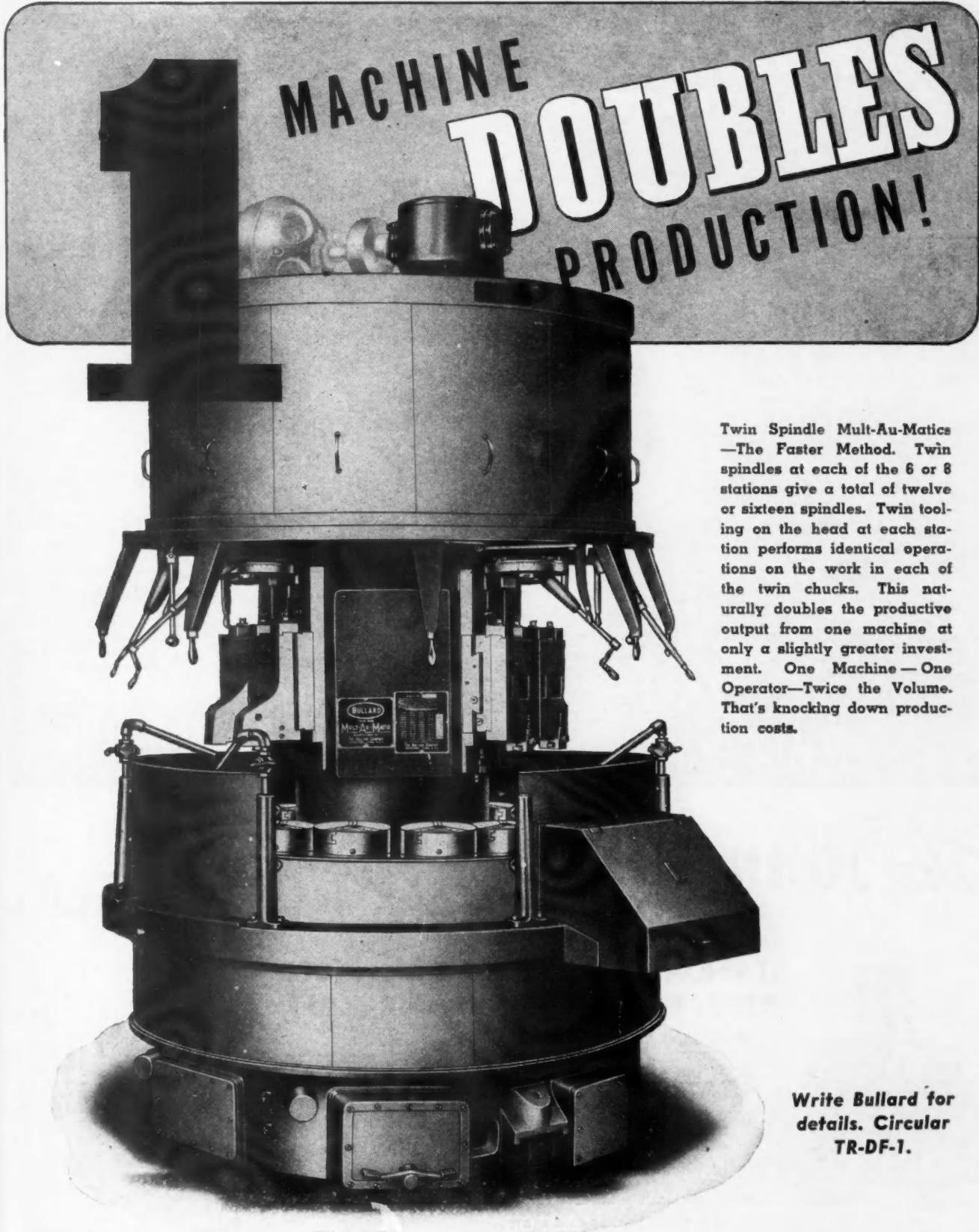
NELSON STUD WELDERS & STUDS

MOTOR STATE

PRODUCTS COMPANY, YPSILANTI, MICHIGAN

Originators of the hydraulic push-button tap





1 MACHINE
DOUBLES
PRODUCTION!

Twin Spindle Multi-Au-Matics
—The Faster Method. Twin spindles at each of the 6 or 8 stations give a total of twelve or sixteen spindles. Twin tooling on the head at each station performs identical operations on the work in each of the twin chucks. This naturally doubles the productive output from one machine at only a slightly greater investment. One Machine—One Operator—Twice the Volume. That's knocking down production costs.

Write Bullard for
details. Circular
TR-DF-1.

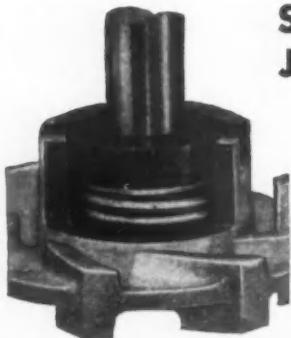
THE BULLARD COMPANY
BRIDGEPORT 2, CONNECTICUT

Easily Installed
★ ON THE PRODUCTION LINE



Trouble-Free
★ ON THE BATTLE LINE

The JOHN CRANE *Bellows* PUMP SEAL

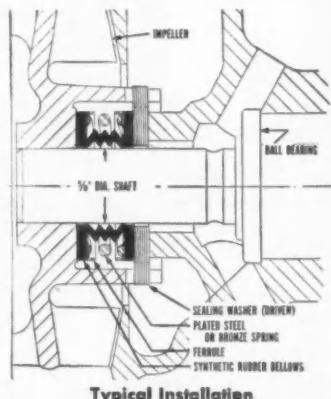


Seal and Washer in Operating Position (Under Load)

STANDARD EQUIPMENT . . . ON JEEPS, TANKS, TRUCKS, AIRCRAFT

- Flexible—Spring and bellows are self-adjusting.
- Simple—Consists only of the factory assembled bellows and spring, and a sealing washer.
- Easily installed—Assembly fits shaft loosely; slides easily into place, either end first (the two ends are identical).
- Dependable—Service records show perfect operation at 100,000 miles and more.

Ask for illustrated Bellows Pump Seal Bulletin



CRANE PACKING COMPANY

BALTIMORE, BOSTON, BUFFALO, CLEVELAND, DALLAS, DETROIT, HOUSTON, LOS ANGELES, NEW ORLEANS, NEW YORK, PHILADELPHIA, PITTSBURGH, SAN FRANCISCO, ST. LOUIS, TULSA

1818 CUYLER AVE. • CHICAGO 13, ILL.

CRANE PACKING CO., LTD., Hamilton, Ontario, Canada.
Branches: Montreal, Toronto, Vancouver

standard Designs Give Constant Velocity up to 38° Maximum Angularity

New Process

TRACTA JOINT

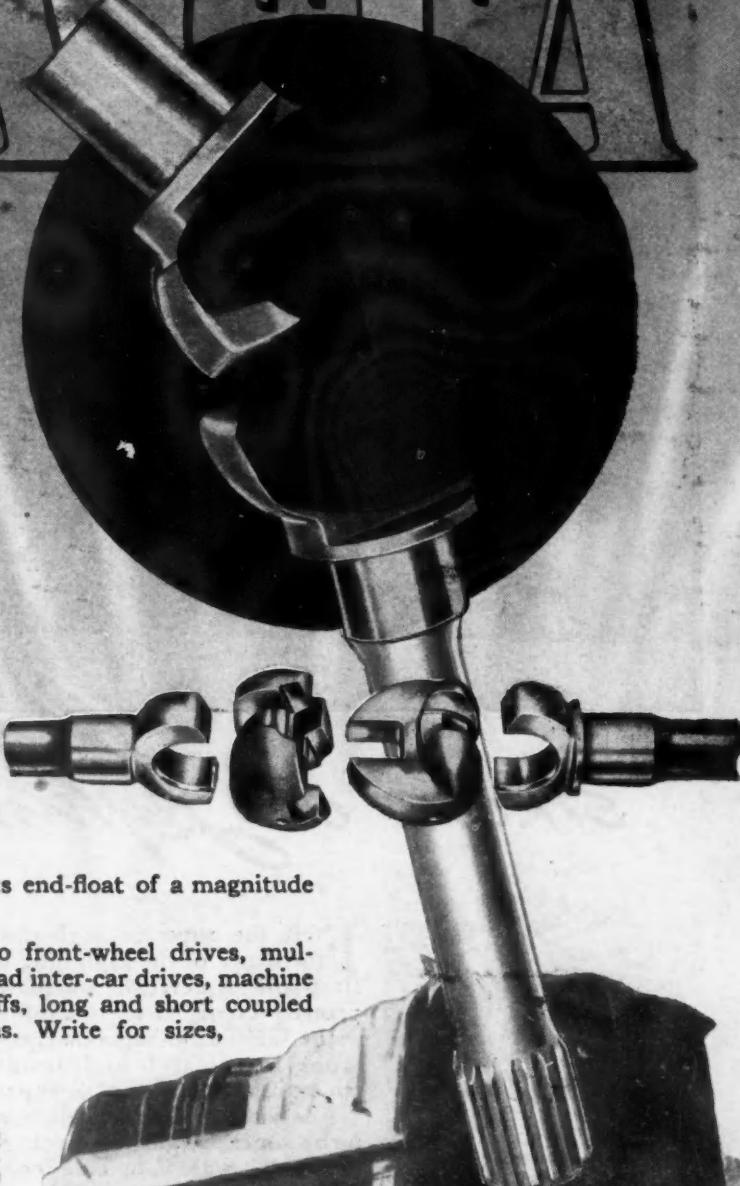
. . . the High Efficiency Universal that's easier to assemble and disassemble

Product of the automotive talent of two nations, the TRACTA constant velocity universal joint is outstanding for:

1. Constant velocity over wider angles—up to 38° in standard models, up to 45° in special models.
2. Extreme simplicity, ONLY FOUR PARTS.
3. Ease of assembly and disassembly, no tools, gages or pre-loading.
4. High efficiency with low friction losses.
5. No brinelling, wide bearing surfaces reduce unit loads.
6. Ability to function even if original alignment is disturbed.
7. More—the standard TRACTA joint permits end-float of a magnitude sufficient for most applications.

TRACTA JOINTS are especially suited to front-wheel drives, multiple-drives, independently-sprung wheels, railroad inter-car drives, machine tools, conveyors, dynamometers, power take-offs, long and short coupled pump drives, marine and aircraft applications. Write for sizes, torque capacities, operating and test data.

When the front wheels swerve, and the rear wheels drop into a shell hole, that's when the easy steering, uniform traction and sturdiness that the New Process Tracta Joint affords, are all important. These joints are one of the reasons why U. S. Army jeeps are able to negotiate muddy and shell torn terrain. (Signal Corps Photo.)



New Process GEAR CORPORATION

Differential Axles, Transmissions . . . Aviation Gears
SYRACUSE 1, NEW YORK

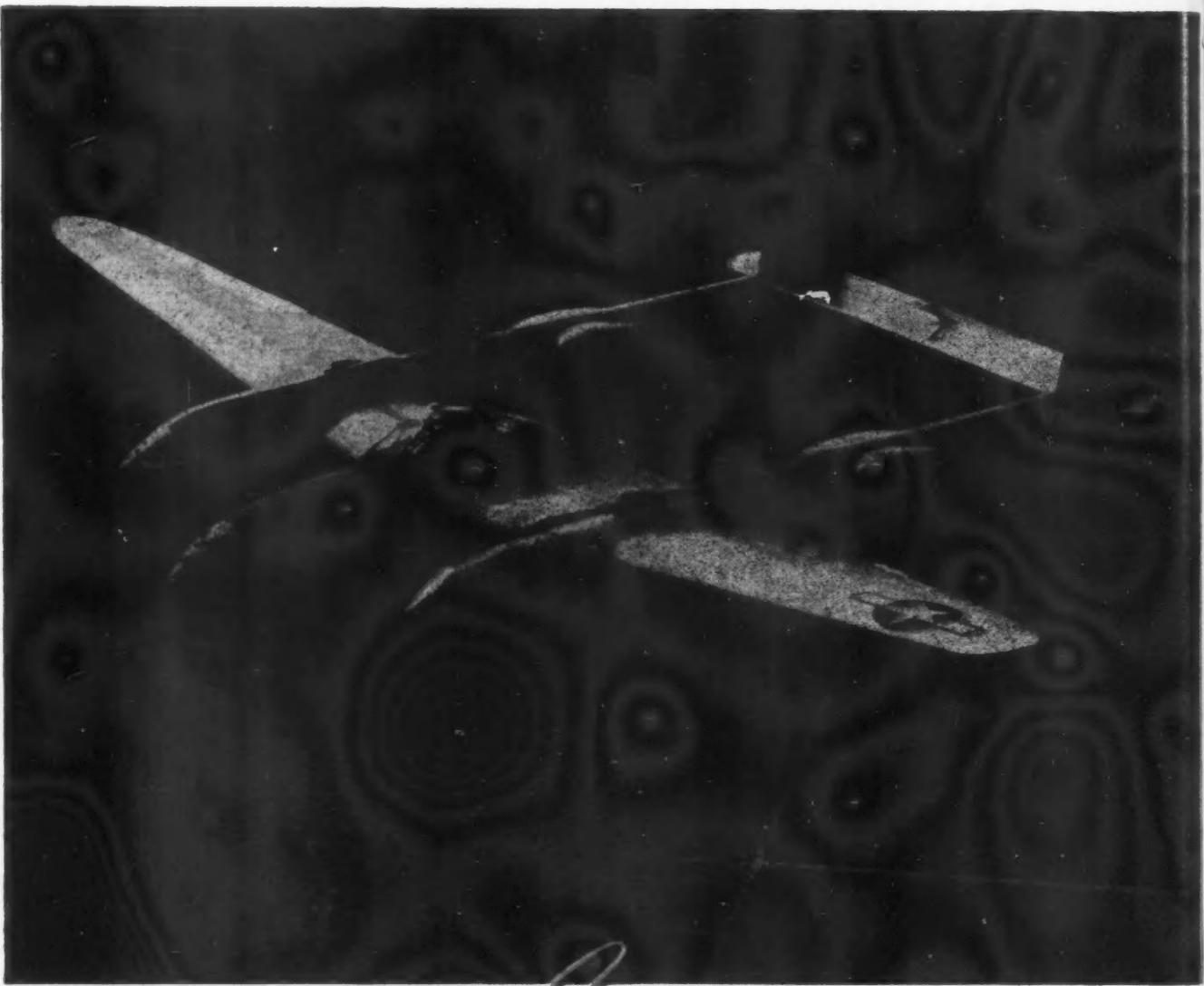


Photo courtesy Lockheed Aircraft Corp.

STROKE OF Lightning IN THE SKY

*... RIDING
ON LUNGS
OF SPECIAL
ALLOY STEEL*

W&D 9494-B

FOR the superior high-altitude performance of the Lightning and other first-line American warplanes, give primary credit to their engine "lungs"—the GE Turbo-Supercharger—a milestone in research and design, and a triumph in metallurgy and production.

Allegheny Ludlum collaborated on turbo-supercharger research for years before the war. Our chief contribution was the development of a commercial technique to centrifugally cast the supercharger diaphragm—an intricate shape which was formerly laboriously fabricated by welding. This casting, made of a highly complex alloy steel which maintains its strength at red-hot temperatures,

was much stronger, more durable and more efficient than the fabricated article. And, even more important, the way had been opened for quantity production.

Already, in gas turbine work and other directions, these developments are bearing additional fruit. Just remember that the function of Allegheny Metal and our other special steels is either to do the thing that once seemed impossible, or to do better what is already being done. Let us help you apply these materials to your needs. • Allegheny Ludlum Steel Corporation, Brackenridge, Pa.

Allegheny Metal is also handled and stocked by all
Joseph T. Ryerson & Son, Inc. warehouses



ALLEGHENY METAL
The Time-Tested Stainless Steel



REMEMBER THE NAME TODAY FOR THE NEEDS OF TOMORROW

Designed and Engineered for
Rapid, Positive Clamping, Maximum Open Clearance

DANLY Kwik-Klamp TOGGLE CLAMPS

To Speed Assembly, Machining Operations, Metal and Plastic Stamping.

For complete data, including tested pressure figures, send for the new Kwik Klamp Catalog.

DANLY MACHINE SPECIALTIES, INC.

2100 South 52nd Avenue

Chicago 50, Illinois





Craftsmen

ARE AS GOOD AS THEIR TOOLS . . .

● Up at the Yale and Towne Manufacturing Company in Stamford, Connecticut, craftsmen have been making the well-known "Yale" locks and builders' hardware for many years. The enviable reputation enjoyed by this company is the result of their insistence for fine quality.

Now as a major contributor to the war effort, Yale and Towne are producing hydraulic pistons and cylinders. Constantly endeavoring to improve their already superior quality, they use the Brush Surface Analyzer in both laboratory and shop. With this instrument they are able to study surface finishes, accurately measured to one millionth of an inch (.000001") from chart recordings instantly made as the specimen surface is explored.

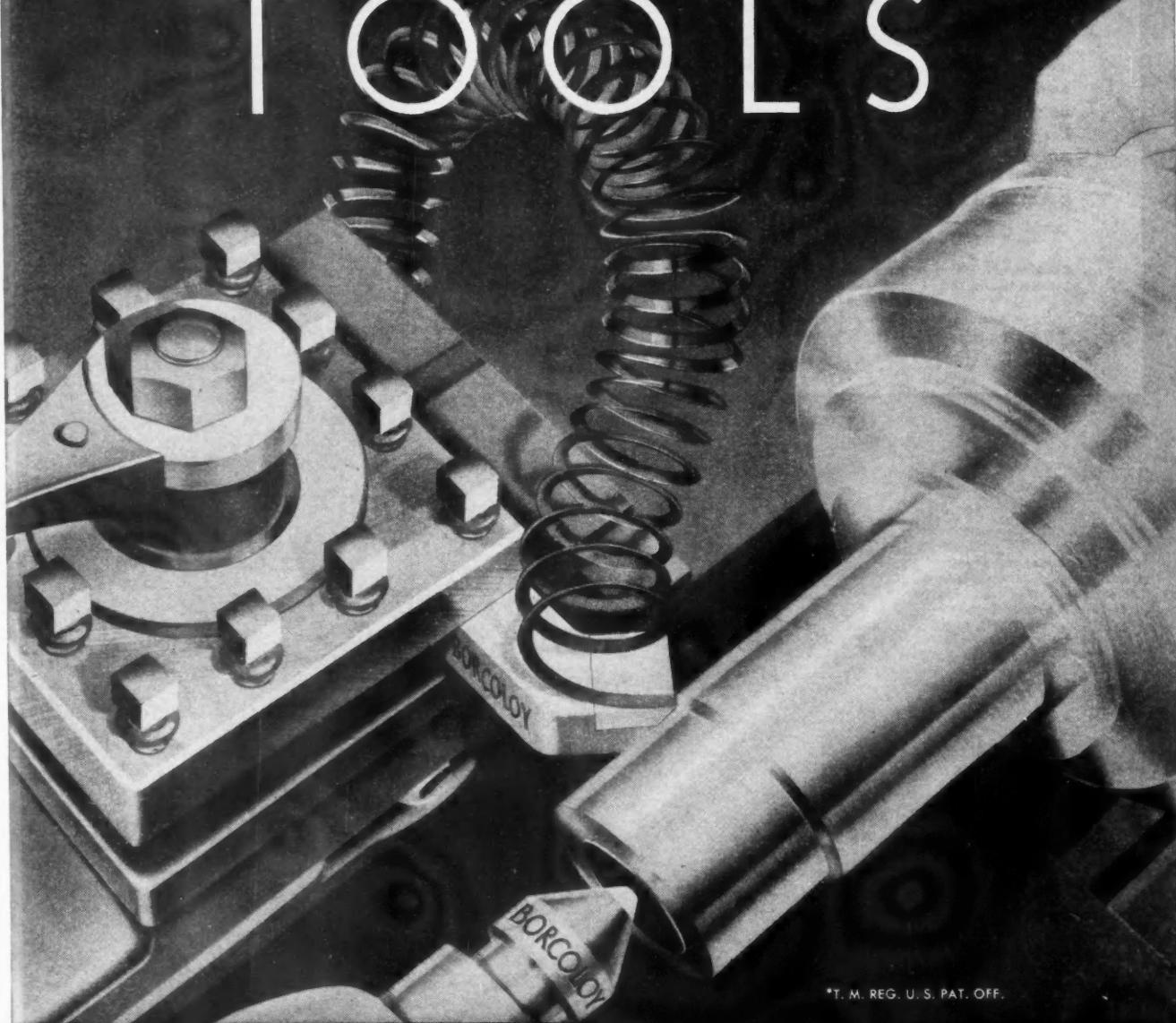
THE BRUSH DEVELOPMENT COMPANY

3473 PERKINS AVENUE • CLEVELAND 14, OHIO

BORCOLOY*

(BORON COBALT ALLOY)

TOOLS



*T. M. REG. U. S. PAT. OFF.

A NEW, SUPER HIGH-SPEED, TOOL STEEL WITH (1) ALL THE DISTINCTIVE FEATURES OF CENTRIFUGALLY CAST ALLOYS (2) HIGH WEAR RESISTANCE DUE TO THE PRESENCE OF BORON AND (3) A MAXIMUM RED HARDNESS IMPARTED BY TWENTY PERCENT COBALT

GENERAL AIRCRAFT EQUIPMENT, INC.
SOUTH NORWALK, CONN.  TOOL DIVISION

PREVIEW FOR YOUR CAST PRODUCTS

It's not by chance that C. W. C. castings meet every requirement for flexibility in design and excellence in quality!

A special metallurgical engineering service plus one of the most modern and completely equipped research laboratories enables C. W. C. to assure casting success in advance. Casting may be your most practical and most economical method of fabrication. Let C. W. C. engineers study your product and make recommendations. Write today... there is no obligation.

**CAMPBELL, WYANT & CANNON FOUNDRY CO.
MUSKEGON, MICHIGAN**

CAST OF C. W. C. ELECTRIC FURNACE ALLOYED METALS

Cylinders "Proferall" Cast Crankshafts "Centrifuse" Brake Drums
Cylinder Heads "Proferall" Cast Camshafts Acid Proof Cylinder Inserts
Centrifugally Cast Cylinder Liners and Sleeves

In addition to the above products C. W. C. has facilities for producing Electric Furnace Alloyed Steel.

Reviewing spectrum of ferrous alloy with densitometer in C.W.C. spectrographic laboratory. This is only one of the many steps taken to assure complete metallurgical control.

**CAMPBELL,
WYANT
& CANNON
FOUNDRIES**

MUSKEGON, MICHIGAN
Henry Street Plant
Sandford Street Plant
C. W. C. Crankshaft Corp.
SOUTH HAVEN, MICHIGAN
National Motor Castings Co.



LANSING, MICHIGAN
Centrifugal Casting Co.
ELSTENDORF, IOWA
Ordnance Steel Foundry Co.

Casting eliminates the restrictions upon design that are inherent in other manufacturing methods. C. W. C.'s revolutionary foundry practice and their development of new electric furnace alloyed metals provide physical properties otherwise unattainable.

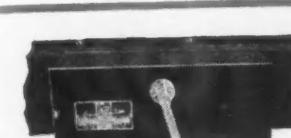
For every circuit protective purpose



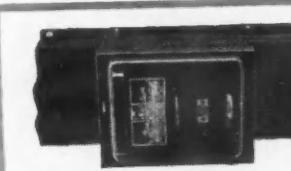
VACU-BREAK SWITCH PLUG



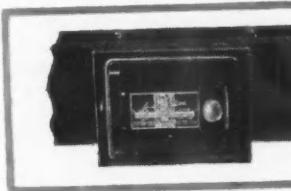
TYPE "PB" BUS PLUG



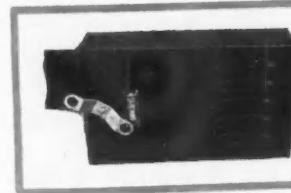
CIRCUIT BREAKER PLUG



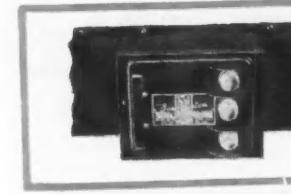
CIRCUIT MASTER PLUG



TEMPERATURE INDICATING PLUG



CAPACITOR PLUG



GROUND DETECTOR PLUG



BULLDOG BUStribution DUCT offers a plug built for the job

One of the outstanding advantages of the BullDog BUStribution DUCT system is the wide variety of circuit protective tap-off plugs available in standard pre-fabricated types.

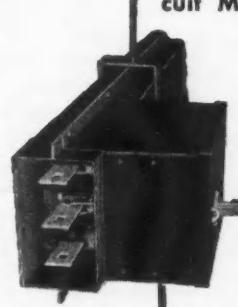
Designed to improve the efficiency of the system through maximum flexibility and adaptability, the standard BullDog Bus Plugs provide a convenient means of current take-off that is completely interchangeable for type, volts, poles and sizes.

All Bus Plugs fasten securely to the flanges of the duct section at the plug-in openings, may be mounted on either or both sides of the duct and require no auxiliary screw clamps or fittings.

Plugs may be removed from duct and moved to a new location at a minimum of labor expense and with no material loss, permitting rapid rearrangement of production machinery to meet expansion programs, change-overs or new production methods.

For complete information on the various BullDog Bus Plugs illustrated in this advertisement, write for our illustrated bulletin 427-2.

Manufacturers of a complete line of Vacu-Break Safety Switches, Panelboards, Switchboards, Circuit Master Breakers and BUStribution SYSTEMS.

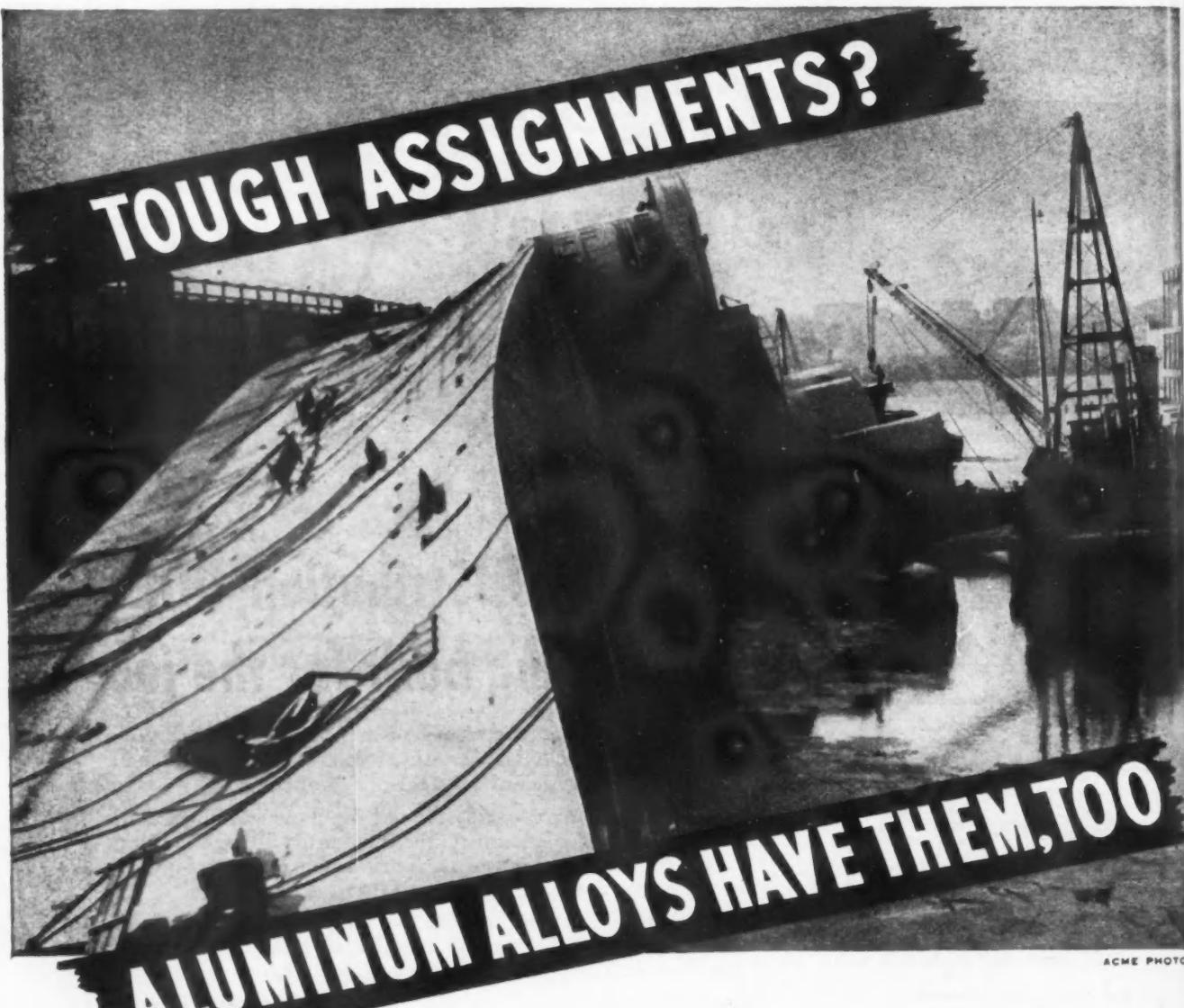


PLUG MOUNTED ON DUCT
This end view of a plug mounted on duct shows how the copper "contact" fingers of the plug clamp over the bus bars in the duct.

For a Bright Future
Buy More War Bonds

BULLDOG
ELECTRIC PRODUCTS CO.

BOX 177, R. P. ANNEX
DETROIT 32, MICHIGAN
BullDog Electric Products of
Canada, Ltd., Toronto, Ont.
Field Engineering Offices in All Principal Cities



ACME PHOTO

THE righting of the Normandie was a tough assignment, but it proved an opportune school for training hundreds of Navy divers.

Aluminum Alloys furnished by us are also meeting tough assignments daily, such as the punishing service in aircraft, tank, and marine engines. At the same time, other much smaller and more delicate parts made from our Alloys are functioning with extreme precision in an equally important, but less spectacular, manner.

In the production of the Alloys to meet these tough assignments, our forces, too, have found a valuable training ground . . . training which will be invaluable to you in your problems of post war production.

The National Smelting
Company
Cleveland 5, Ohio

Niagara Falls Smelting &
Refining Corp.
Buffalo 17, New York

Sonken-Galamba
Corporation
Kansas City 18, Kansas

U. S. Reduction Co.
East Chicago, Indiana

Aluminum and
Magnesium, Inc.
Sandusky, Ohio

The American Metal
Company, Limited
New York City 6

Apex Smelting Co.
Chicago 12, Illinois

Berg Metals Corporation
Los Angeles 11, California

The Cleveland Electro
Metals Co.
Cleveland 13, Ohio

Federated Metals Division
American Smelting and
Refining Company
New York City 5 and Branches

General Smelting Company
Philadelphia 34, Pennsylvania

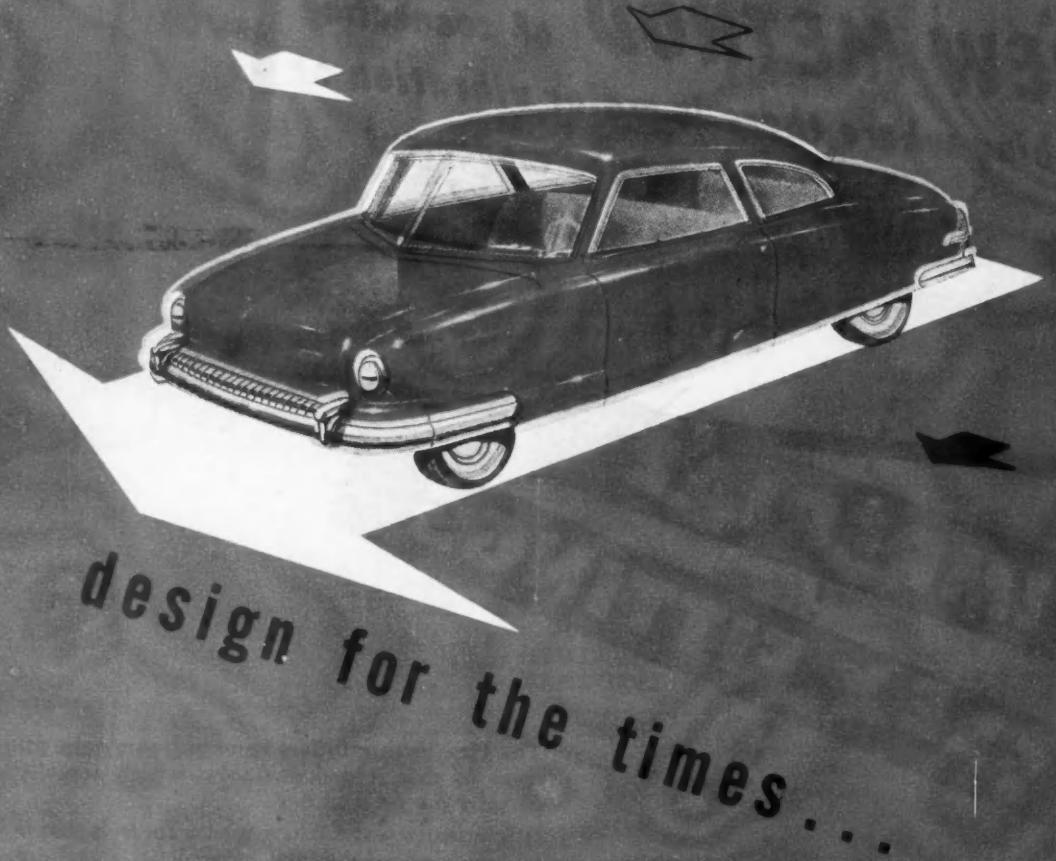
Samuel Greenfield Co., Inc.
Buffalo 12, New York

William F. Robbins, Inc.
Aurora, Illinois

R. Lavin & Sons, Inc.
Chicago 23, Illinois

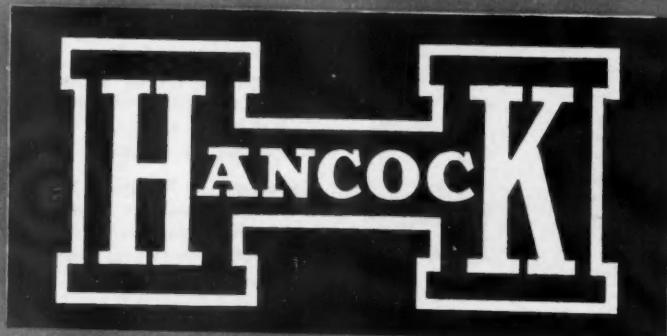
Aluminum RESEARCH INSTITUTE

111 West Washington Street, Chicago 2, Illinois



design for the times . . .

Does your product indicate latches and hinges of unusual design? For 38 years Hancock products have been smartly designed for better appearance, convenience and safety. Consider Hancock for increased volume production of unusual or standard assemblies.

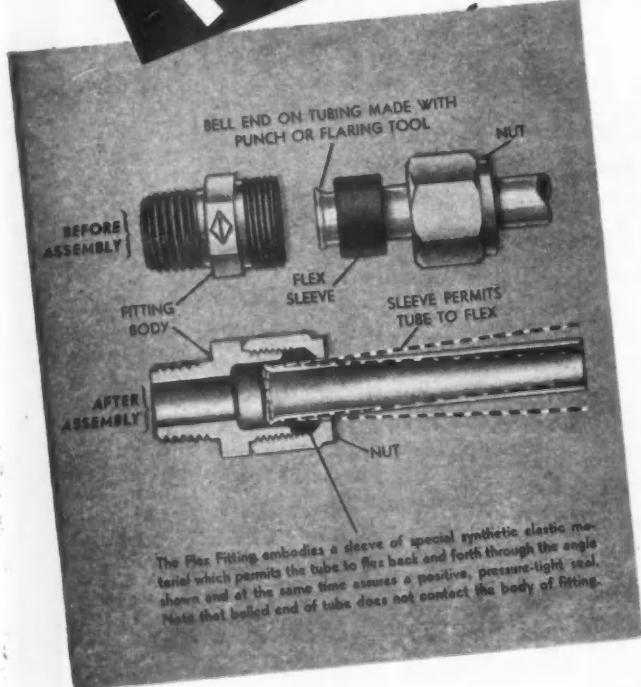


GEORGE P. HOOPER • Sales Manager
919 FISHER BLDG., DETROIT 2, MICHIGAN
MADISON 4740

HANCOCK MANUFACTURING COMPANY, JACKSON, MICHIGAN

NEW METHOD of connecting
tubing where there is major vibration or
minor tube movement

IMPERIAL
FLEX FITTINGS



The Flex Fitting differs from ordinary tube fittings in that it makes a joint which actually permits the tube to flex.

It is unsurpassed for use where there is major vibration or minor tube movement . . . where tubing lines must stand up under heavy pounding service. Flex Fittings are already being used as standard equipment by many manufacturers of Diesel engines, trucks, tractors, oil filters, carburetors, heavy power equipment, etc.

Consider Flex Fitting advantages:

1. Makes a joint that is virtually indestructible by vibration and that will withstand considerable mechanical shock.
2. Eliminates need for costly flexible hose lines in many instances.
3. Can be used with all kinds of metal tubing—seamless or seamed.
4. Easy and speedy to install. Can be disconnected and reconnected repeatedly without danger of leakage.
5. Proved by extensive service in the field.

Catalog No. 334 gives complete engineering data on Flex Fittings, including types, sizes, dimensions, specifications and application information. Write for your copy.

THE IMPERIAL BRASS MANUFACTURING COMPANY
1241 W. Harrison St., Chicago 7, Ill.

IMPERIAL

Headquarters for Tube Fittings
and Tube Working Tools

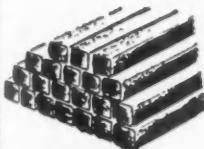


FORGINGS POSSESS HIGH STRENGTH and TOUGHNESS

● Forging, or hot working metal, with closed impression dies directions the fiber structure, inherent in steel, to provide high strength and toughness where most needed to resist stress or shock. Maximum strength for a given amount of weight is just one of seven advantages that forgings offer.

These Are Other Advantages:

FORGINGS CONSERVE
METAL



FORGINGS LESSEN SCRAP;
UNUSUALLY
FREE OF
CONCEALED
DEFECTS;
PRACTICALLY
NO REJECTIONS



FORGINGS REDUCE DEAD WEIGHT
THROUGH MAXIMUM STRENGTH
IN LIGHTER
SECTIONAL
THICKNESSES



FORGINGS FACILITATE RAPID
ASSEMBLY THROUGH
WELDING
ADAPTABILITY



FORGINGS REQUIRE LESS TIME
TO MACHINE AND FINISH
BECAUSE SHAPED
IN CLOSED DIES



FORGINGS REDUCE ACCIDENTS
TO MEN AND MACHINES
THROUGH
A GREATER
MARGIN OF
SAFETY



Are you obtaining the utmost benefit from your use of forgings? A recheck of every forged part you use against these advantages may reveal unusual benefits which have been unintentionally neglected or overlooked. Even manufacturers who have had long experience in the use of forgings have found further opportuni-

ties to reduce weight, improve product performance and effect worth-while savings by rechecking parts against these advantages. • Consult a forging engineer connected with your

source of supply. His broad experience will be helpful to you in obtaining the utmost benefit from each advantage in your use of forgings.



DROP FORGING ASSOCIATION

605 Hanna Building • Cleveland 15, Ohio



This new booklet will help you to avoid misestimating the qualities required to meet a specific service condition. Metal quality can be developed to the exact degree required by the forging process, and this booklet presents many examples that prove it. It contains 40 pages of factual information about the development of maximum strength and toughness in forgings. Over 200 illustrations are used, most of them for the purpose of showing directioned fibre structure, or grain flow as obtained by forging. This booklet has been prepared for the guidance of design engineers, metallurgists, and other technicians, production and management executives; whose task it is to determine the metal quality required for safety and dependable performance. Ask your source for forgings for a copy, or write direct.



Drop Forging Topics contains technical information for design engineers, production executives, metallurgists, and other technicians who specify and use metal parts for operating mechanisms. It is published ten times a year; usually contains 8 pages and is available upon request. Is your name on *Topics* mailing list?

DROP FORGING ASSOCIATION

605 Hanna Building • Cleveland, Ohio

Please send me:

Booklet on "Metal Quality - How Hot Working Improves the Properties of Metal."
 "Drop Forging Topics," issued ten times a year.

Name Position

Company

Address City State

Please attach this coupon to your business letterhead.

-without a shadow of doubt



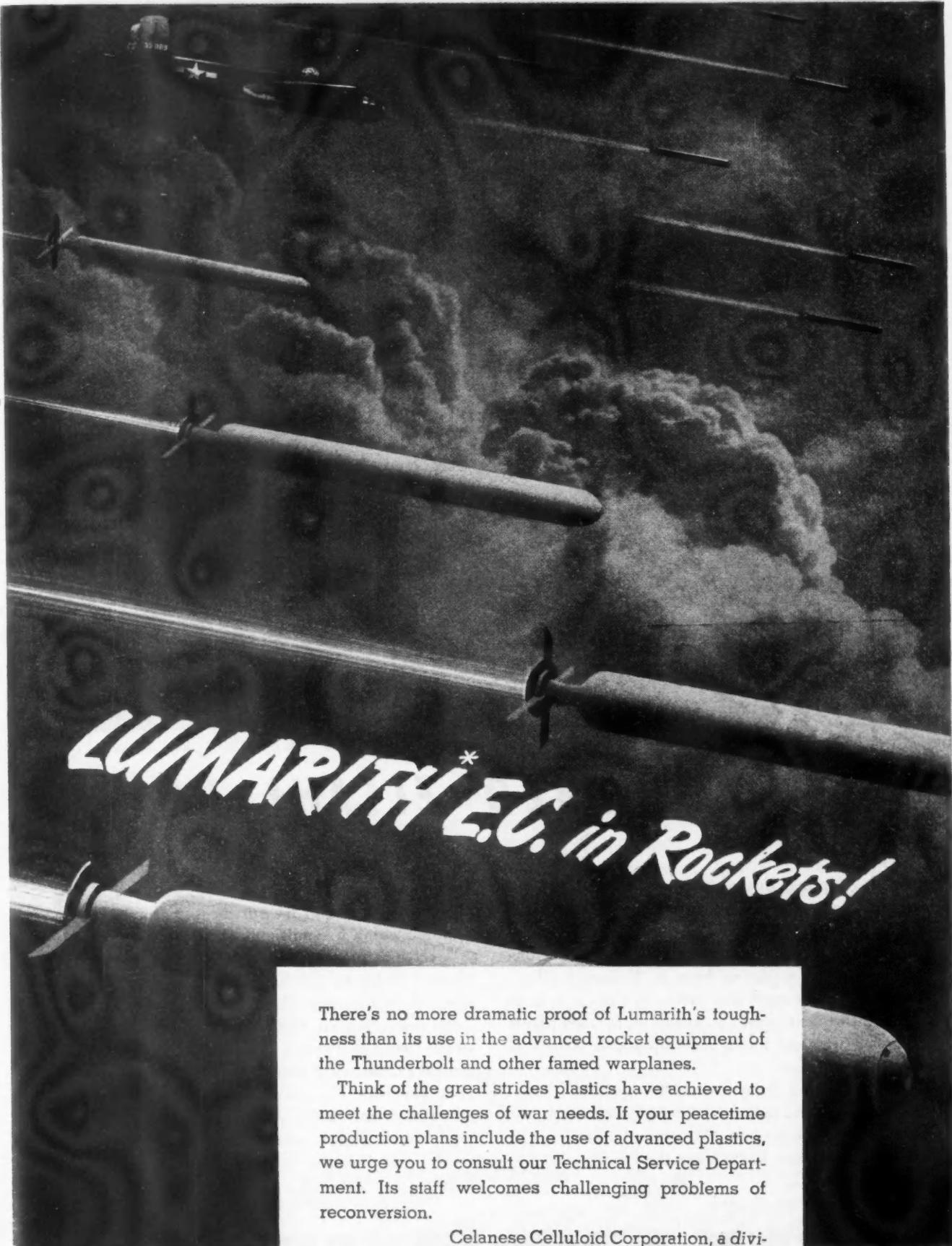
THE PORTABLE PYROMETER POTENTIOMETER

THAT WAS DESIGNED AND SERVED IN MAKING TEMPERATURE SURVEYS IN MOVING VEHICLES UNDER CONDITIONS OF VIBRATION AND EXTREME AMBIENT TEMPERATURE BEFORE THE WAR IS SERVING UNDER CONDITIONS OF GREATER VIBRATION AND MORE EXTREME AMBIENT TEMPERATURE NOW, AND WILL BE BETTER ABLE TO MEET THE NEW PEACE TIME REQUIREMENTS OF THE FUTURE.

THE LEWIS ENGINEERING CO.

Specialists in Engine Temperature Measurements
• NAUGATUCK, CONNECTICUT •

• POTENTIOMETERS • • • • • SELECTOR SWITCHES • • • • • THERMOCOUPLES •
• PYROMETERS • • • • • RESISTANCE THERMOMETERS • • • PROTECTION TUBES •



There's no more dramatic proof of Lumarith's toughness than its use in the advanced rocket equipment of the Thunderbolt and other famed warplanes.

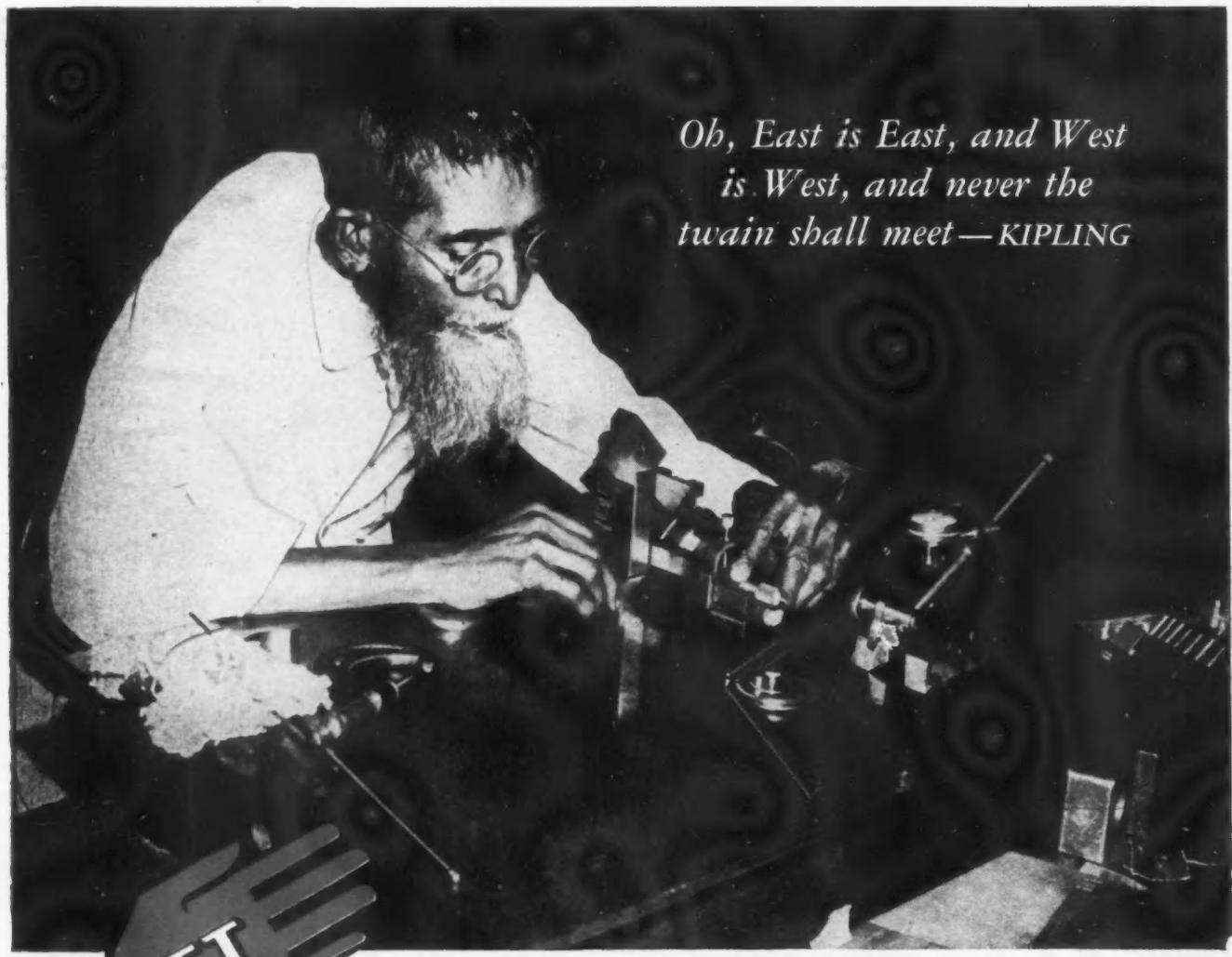
Think of the great strides plastics have achieved to meet the challenges of war needs. If your peacetime production plans include the use of advanced plastics, we urge you to consult our Technical Service Department. Its staff welcomes challenging problems of reconversion.

Celanese Celluloid Corporation, a division of Celanese Corporation of America, 180 Madison Avenue, New York City 16.

A Celanese^{} Plastic*

*Reg. U. S. Pat. Off.

Reproduced from original designed for the September issue of Air News by Robert Lindgren, Art Editor.



*Oh, East is East, and West
is West, and never the
twain shall meet—KIPLING*

MEET

MOHAMED ELLAHI BUKHSH

No, Mr. Kipling, this picture was *not* taken in the modern factory of a Western industrial nation. It is India . . . a new and progressive India which is proving that East and West *can* meet, and get along famously. The workman here is Mohamed Ellahi Bukhsh, 62, an expert with precision tools in a large Indian armament plant . . . one of many such plants equipped with the finest, most up-to-date American machines and tools.

Here, though halfway around the world in a country taking its first industrial "steps," accuracy is not a hit-or-miss proposition. For example, here on the job with Mohamed Bukhsh are the familiar Pratt &

Whitney Hoke Precision Gage Blocks, a basic, unchanging standard of measurement guaranteed to be accurate within five millionths of an inch.

Today, there are no geographical limits for accuracy. Mohamed Ellahi Bukhsh and thousands of newly-skilled workers like him all over the world are daily depending on Pratt & Whitney machine tools, small tools, and gages—on P&W's 84-year background as masters of *basic accuracy for mass production*. They are discovering what Western manufacturers have known for years—that Pratt & Whitney products are built to one rigid standard of accuracy which never changes.

PRATT & WHITNEY

Division Niles-Bement-Pond Company

WEST HARTFORD 1, CONNECTICUT





THE SCORPION *Sting* — THAT MUST NOT MISS



THERE is no room for error when the red ball of a Jap plane or the cross on the wings of a Nazi fighter is framed in the tail gun sights of our fighting fortresses. And it takes perfect teamwork to blast such darting targets—teamwork between a well-trained gunner and precision built guns, gun mounts and sight assemblies. An error of just a couple of a thousandths of an inch by any part of the team would spell a miss of hundreds of yards. Through the behind-the-lines teamwork of the men and women at Guiberson the tail gunners of our B-17's are assured of receiving high precision gun mounts that have passed the most rigid inspection and are worthy members of the fighting team. Backed by more than 25 years of engineering and production experience, the three Guiberson plants specialize in precision machine tool and sheet metal operations of all kinds.

GUIBERSON SPACE HEATING UNITS

The ideal, low-cost, quick heating unit for hangars, shops and those hard-to-heat corners in buildings. Now in limited production and available for delivery. Write for complete information



ESTABLISHED
1919



America's only radial air-cooled Diesel engine built by Guiberson

Guiberson USA

THE GUIBERSON CORPORATION
GUIBERSON DIESEL ENGINE COMPANY

DALLAS, TEXAS

PAGE *Welding* ELECTRODES

NEW!



for
AC
or
DC



Here's the newest member of the **PAGE** Electrode family. It is a general-purpose electrode, especially designed for welding light-gage mild steel in flat, vertical, overhead and horizontal positions with either alternating or direct current. The **PAGE HI-TENSILE AF ELECTRODE** produces an exceptionally smooth and uniform bead, slightly convex. This makes it most satisfactory for fillet and lap welds. For further details about this new electrode, get in touch with your **PAGE** distributor.

PAGE STEEL AND WIRE DIVISION

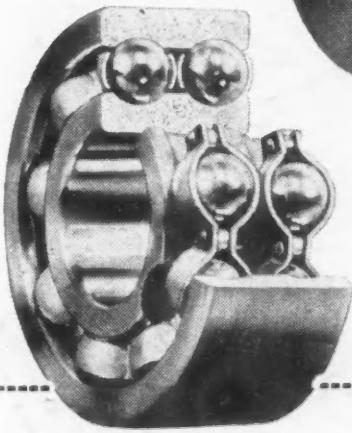
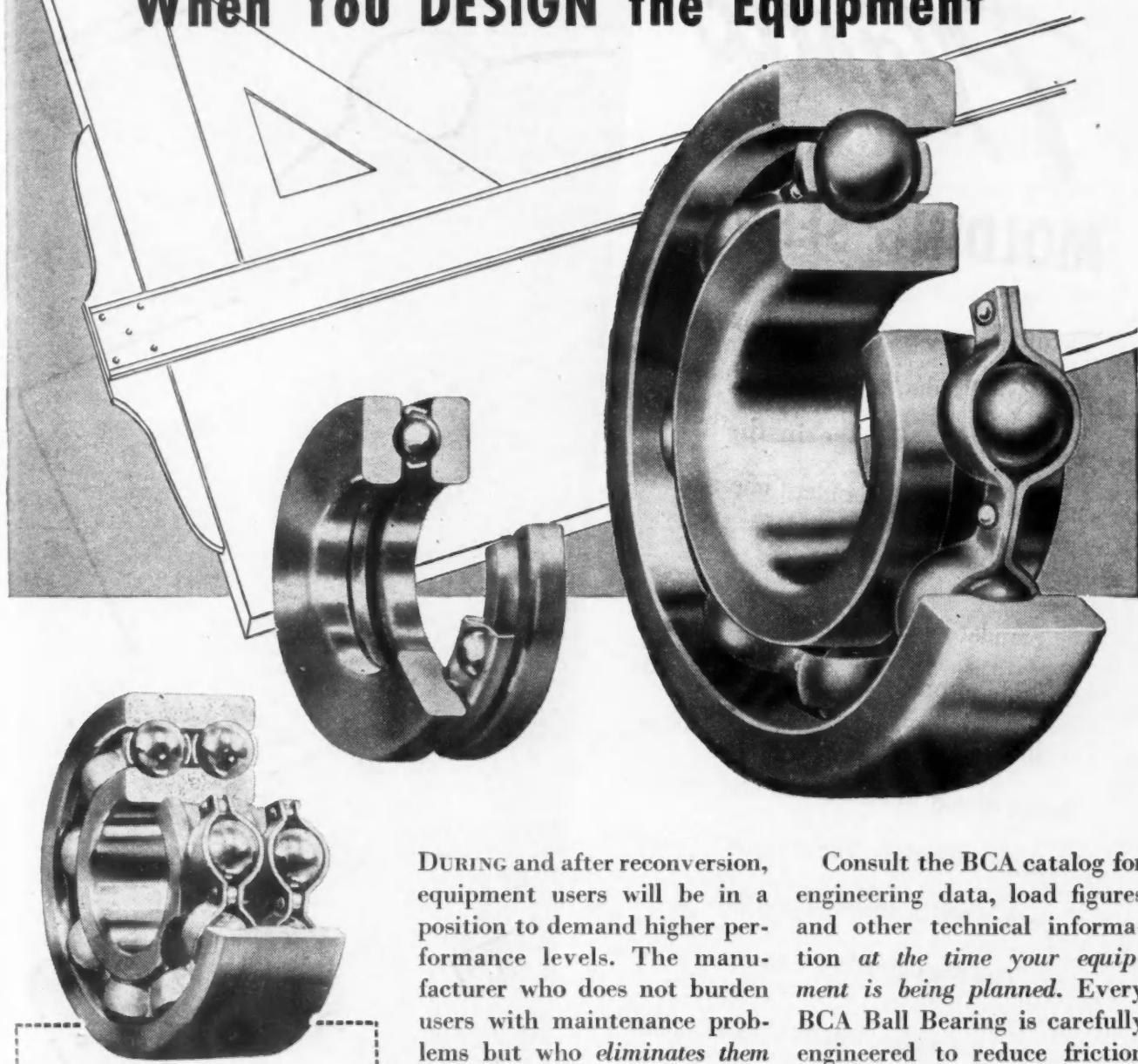
Monessen, Pa., Atlanta, Chicago, Denver, Los Angeles, New York,
Pittsburgh, Portland, San Francisco

AMERICAN CHAIN & CABLE COMPANY, Inc.
BRIDGEPORT • CONNECTICUT



ESSENTIAL PRODUCTS • TRU-LAY Aircraft, Automotive, and Industrial Controls • TRU-LOC Aircraft Terminals • AMERICAN CABLE Wire Rope
TRU-STOP Brakes • AMERICAN Chain • WEED Tire Chains • ACCO Malleable Castings • CAMPBELL Cutting Machines • FORD Hoists, Trolleys
HAZARD Wire Rope • MANLEY Auto Service Equipment • MARYLAND Bolts and Nuts • OWEN Springs • PAGE Fence, Shaped Wire,
Welding Wire • READING-PRATT & CADY Valves • READING Steel Castings • WRIGHT Hoists, Cranes • WILSON "Rockwell" Hardness Testers
In Business for Your Safety

Reduce Equipment Maintenance When You DESIGN the Equipment



Treat Bearings Right! They're in the Fight!

1. Store bearings in a dry place and do not unwrap them until ready to use.
2. When mounting bearings, protect the shaft and be sure that the housing covers are tight to prevent entry of dirt.
3. Use only neutral mineral lubricants and do not over-lubricate.

DURING and after reconversion, equipment users will be in a position to demand higher performance levels. The manufacturer who does not burden users with maintenance problems but who eliminates them through sound planning in his own engineering department will gain an important competitive advantage.

Consult the BCA catalog for engineering data, load figures and other technical information *at the time your equipment is being planned*. Every BCA Ball Bearing is carefully engineered to reduce friction and wear—two of the most important factors in maintenance. Study the possibilities of these bearings now.

BEARINGS COMPANY OF AMERICA, LANCASTER, PENNA.



RADIAL • ANGULAR CONTACT • THRUST
BALL BEARINGS

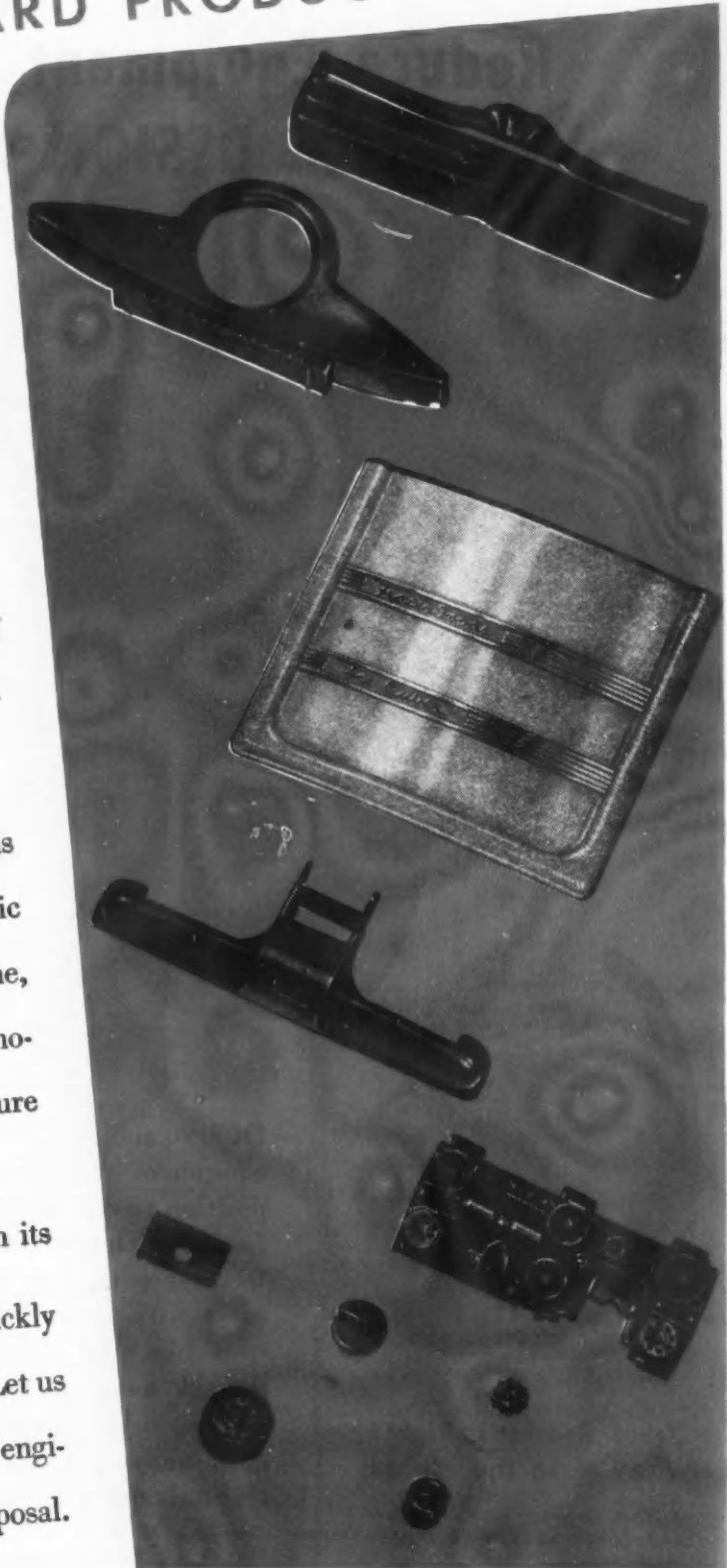
IT'S A STANDARD PRODUCT

Plastic MOLDING SERVICE

Through years of experience, the Standard Products Co. has acquired a wealth of knowledge in the art of molding plastics. Standard offers complete molding service.

Standard's molding equipment is capable of producing items of phenolic cellulose-acetate, butyrate, polystyrene, ethocel and other plastic and thermoplastic materials. These facilities assure perfection in the molding job.

The Standard Products Co., with its great resources, can do your job quickly and effectively at moderate cost. Let us have the necessary data and our engineers will submit designs and proposal.



THE STANDARD PRODUCTS COMPANY

505 Boulevard Bldg.

General Offices and Research Laboratory

Woodward Ave. at E. Grand Blvd.

Detroit 2, Mich.

BAKER

UNIT TYPE • FOUR WAY
Multiple Spindle
DRILLING MACHINE

Important

IN WAR PRODUCTION OF AXLE HOUSINGS

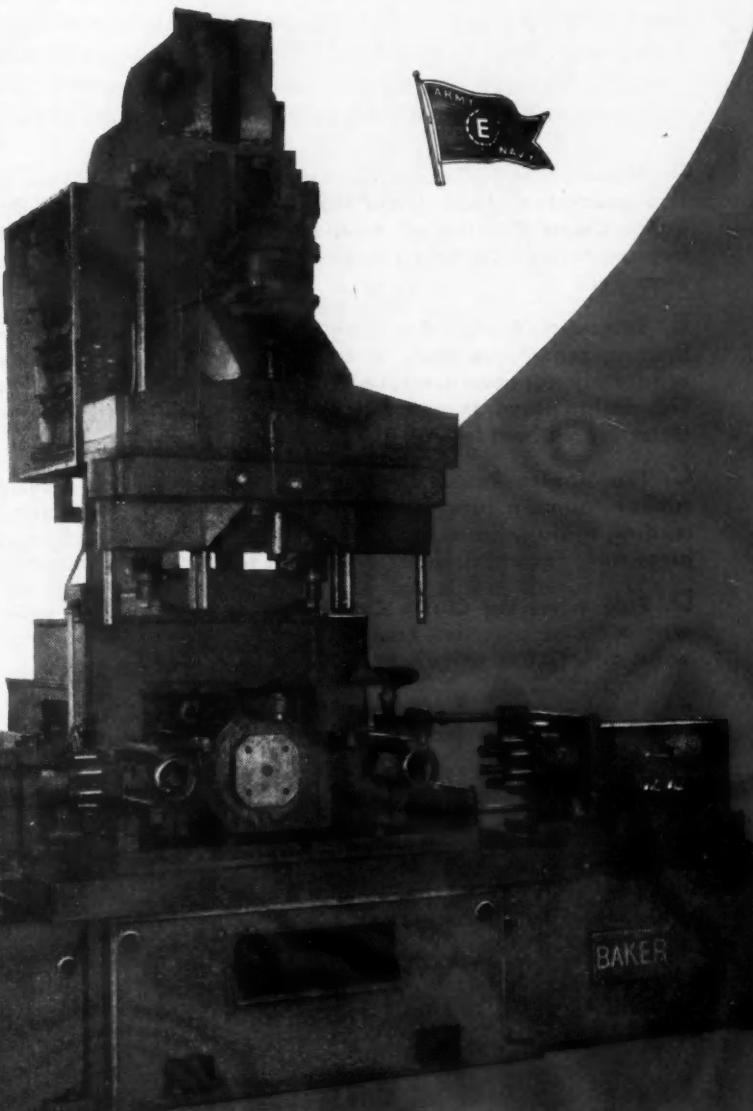
This machine serves a distinct purpose. Vital to the war effort now, it will be equally important for Post-War production, when truck transportation will play such a large part in reconversion.

Manufacturers whose plants are tooled with BAKER automatic cycled multi-operation machines will be fortunate indeed when reconversion comes, because BAKER Machines are flexible and can be quickly converted to Peace-time requirements.

Let the BAKER Engineering Department solve your drilling, boring and tapping problems.

The Machine illustrated is constructed and operated as follows:

Two standard BAKER 7½A14 self-contained hydraulic feed units, mounted to right and left on the main horizontal bed, drill eight holes in each end of the flange. The vertical unit, which is a standard BAKER simplified 30-HO vertical hydraulic feed unit, drills one center pipe tap hole and six holes later tapped in bosses on one side of housing. The vertical unit is mounted on a straddle frame of bridge construction allowing for the mounting of another BAKER 7½A14 unit to the rear at right angles to the two side units. The rear horizontal unit has eleven spindle heads for drilling ten holes in banjo surface and one hole to right of banjo holes. Electrical control panel is mounted on side of vertical unit frame high off the floor, away from coolant dirt and dust. Machine is fully automatic in its cycling and operated by push button station convenient to operator.



BAKER BROTHERS, INC.
TOLEDO 10, OHIO, U.S.A.

A Size and Type of COUPLING for every need...

MORSE

Closely associated with the design and operation of power transmission equipment is the proper selection of Flexible Couplings. That is why Morse through its years of experience in this field has concentrated on the manufacture of a line of couplings that properly suits most kinds of service.

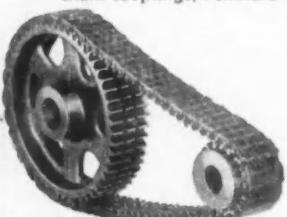
A. Morse series DRC couplings consists of only three all steel parts: two sprockets and a length of Morse "American Standard" Double Roller Chain. The use of double chain increases sprocket tooth bearing areas, affording greater power capacity for given over-all diameter.

B. Standard Morflex Couplings derive their flexibility from a floating center assembly to which two steel hub members are separately connected through resilient rubber trunnion blocks. This design prevents metal-to-metal contact, allows for maximum distortion without loss of efficiency.

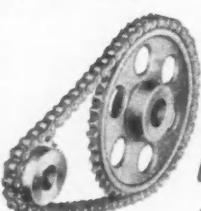
C. The Morflex Radial Coupling is constructed with a series of rubber trunnion blocks assembled on equally spaced pins extending radially from the hub member, and supported in a two piece metal housing, withstands both torsional and thrust loads.

D. Free Wheeling Clutch Coupling: A chain coupling provided with a Morse precision Free Wheeling clutch for standby power units, or selective drive service.

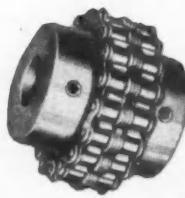
Other Morse precision products include silent and roller chain drives, sprockets, silent chain couplings, Fullmore clutches, automotive timing chains and marine transmissions.



Whatever your power transmission problem may be, remember that 40 years of Morse Chain experience in the design, research and manufacture of dependable power transmission equipment are available to you. Consult Morse for this service.



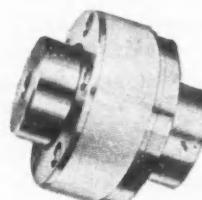
D. Free Wheeling Clutch Couplings for standby power, selective drive service.



A. Morse Roller Chain Couplings distribute heavy load stress.



B. Morflex Couplings allow for maximum distortion in use.



C. Morflex Radial Couplings withstand torsional and thrust loads.

SPROCKETS

CHAINS

FLEXIBLE COUPLINGS

CLUTCHES

MORSE *Roller and Silent* CHAINS

MORSE CHAIN COMPANY • ITHACA, N.Y. • DETROIT 8, MICH. • A BORG-WARNER INDUSTRY



What makes 'em TICK...

HAMILTON ENGINES

BUT KEEP THAT GUARD UP!

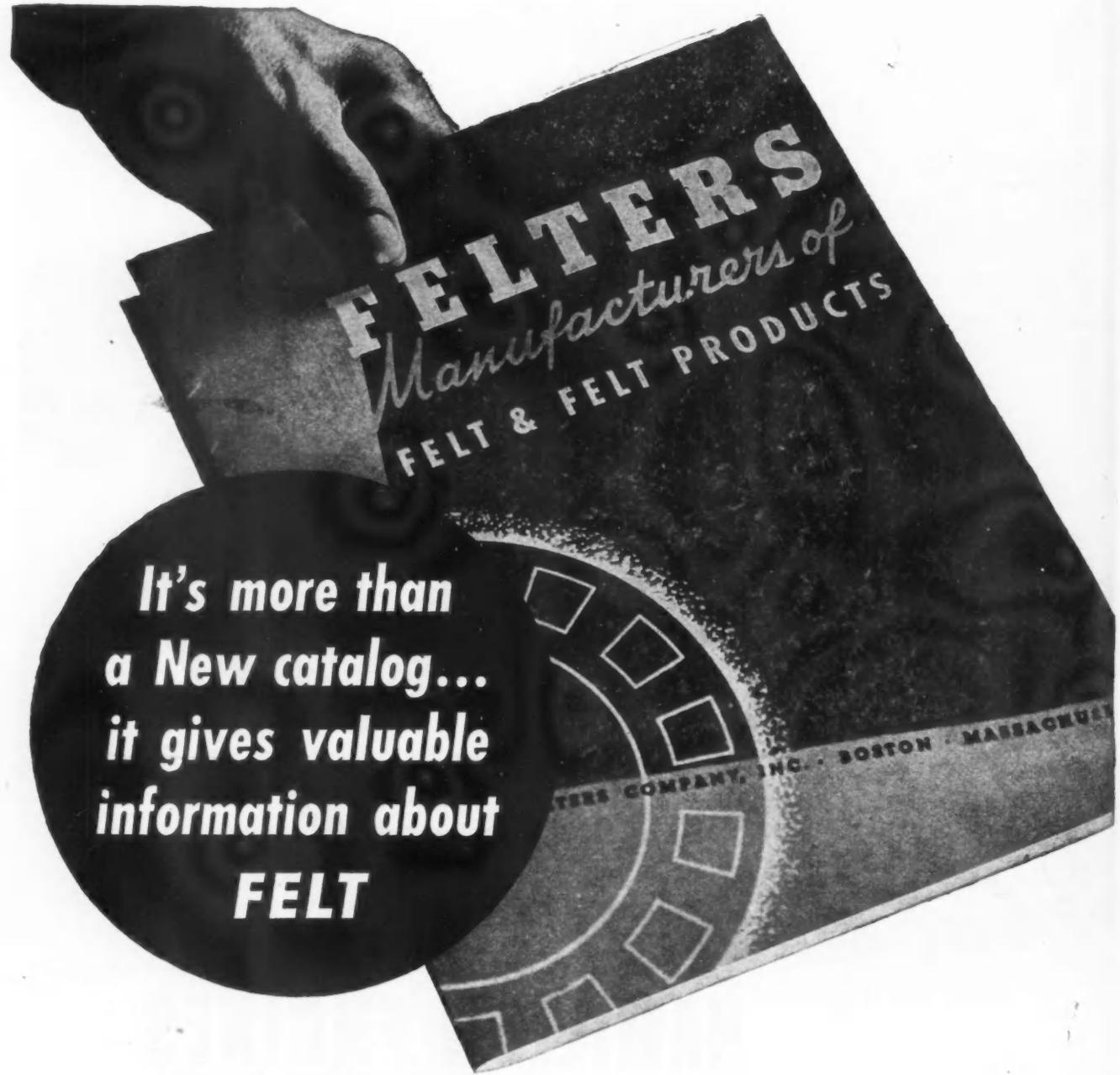
Hamiltons power one-third of all the
Liberty Ships.

The pendulum swings with them to victory.



GENERAL MACHINERY CORPORATION
HAMILTON, OHIO

THE NILES TOOL WORKS CO. • THE HOOVEN, OWENS, RENTSCHLER CO. • GENERAL MACHINERY ORDNANCE CORPORATION



**It's more than
a New catalog...
it gives valuable
information about
FELT**

...Send for it today!

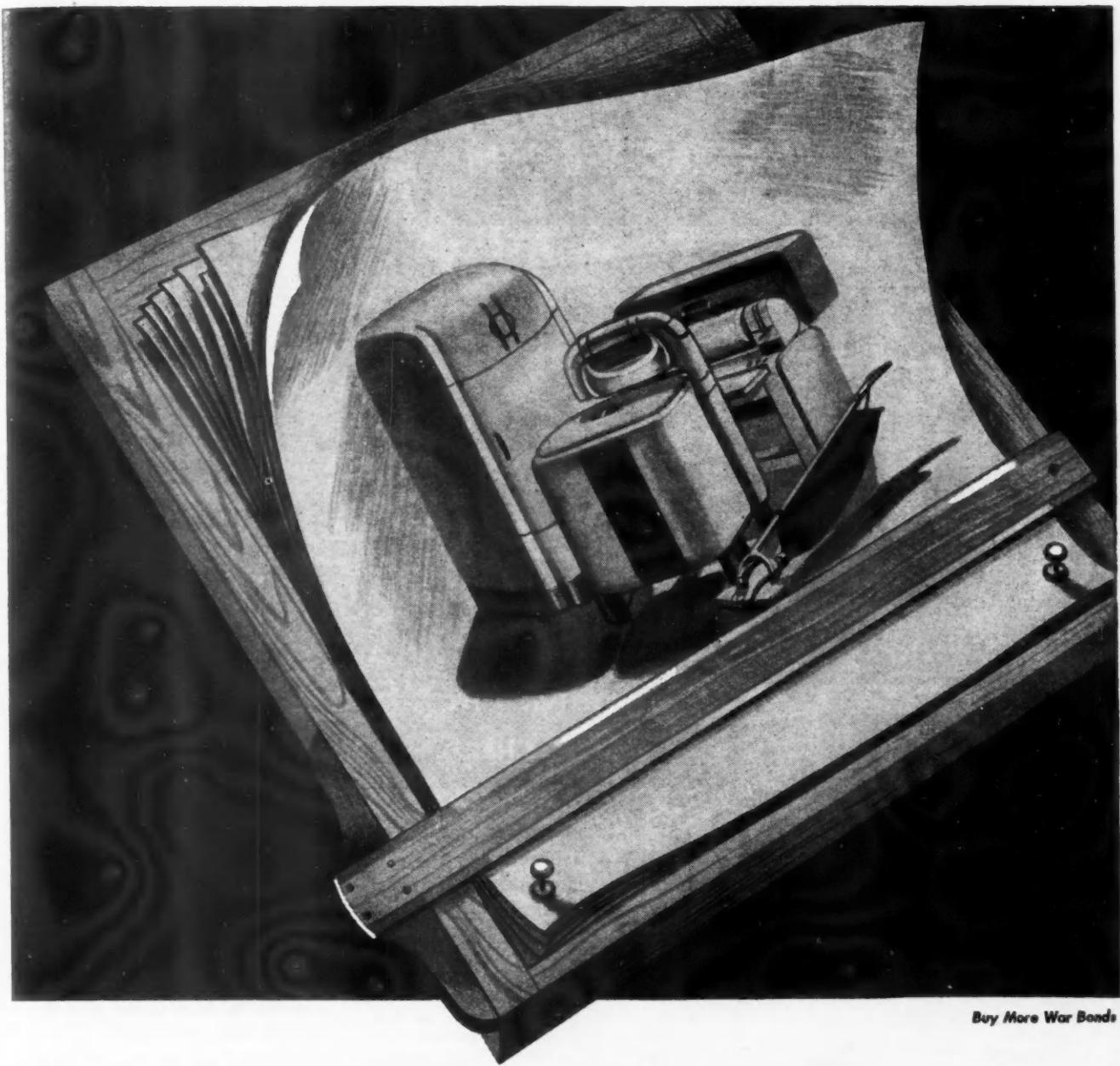
The new Felters Catalog gives you the fundamentals of felt functions . . . tells about the different grades and properties of felt . . . the *design* properties of felt . . . the acoustical and insulating qualities of felt . . . and a lot more important information. It is a ready reference . . . an easily understood "short course" in the various uses and applications of felt.



THE Felters Company

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Mills: Johnson City, New York; Millbury, Massachusetts; Jackson, Michigan*



Buy More War Bonds

It's not too soon to write "Allied Precision" into your postwar plans

Even if your postwar products are only in the drawing board stage, we want to show how Allied Products Corporation might help you *right from the start*.

For years Allied has been famous for its precisely made steam-heated plastic molds, sheet metal dies, R-B interchangeable punches and dies, and other vital production tools. Now, it has won new distinction through the excellence of millions upon millions of hardened and precision ground wartime parts. Among the varied shapes and sizes, are airplane engine and gun parts finished to within limits of two ten-thousandths of an inch.

Soon, the hundreds of skilled craftsmen responsible for

Allied Precision—the amazing machinery of modern mass production—and a practical, mature business experience will be available to the producers of peace-time goods. Here is a "pool of precision" for manufacturers seeking a dependable, economical source of outstanding tools and parts. Won't you write us today?

"IT'S AN ALLIED PRODUCT" . . . Allied Products Corporation and its divisions, Richard Brothers and Victor-Peninsular, in Detroit and Hillsdale, Michigan, also make: Jigs and fixtures, cold forged parts, cap screws and other special products.

**ALLIED PRODUCTS
C O R P O R A T I O N**

Department 16, 4646 Lawton Avenue, Detroit 8, Michigan

Design that part in

ArmaSteel*



IN THE AUTOMOTIVE AND DIESEL INDUSTRIES

PISTONS

A leading Diesel manufacturer has used ArmaSteel pistons for years, chalking up impressive records of continuous service.

GEARS

Faster gear production through casting closer to finished dimensions and easier machining is a leading advantage of ArmaSteel.



CLUTCH THROWOUT COLLARS



The special qualities of ArmaSteel well fit it for the heavy loads and wear to which throwout collars are subjected.

**BUY ANOTHER
WAR BOND FIRST**

The metal that boosts output, cuts costs, saves time, when "GO-Day" comes

The time lag from plan board to finished product can be cut sharply with ArmaSteel, the metal that has proved its mettle in hundreds of strategic war uses. In your reconversion plans consider these factors:

1. ArmaSteel is cast to conform closely to final shapes, cutting machining time, lowering cost of manufacture and reducing scrap loss.
2. ArmaSteel is much easier to machine than steel bar stock and forgings of the same Brinell hardness.
3. ArmaSteel has a uniform structure and a high yield ratio, with good fatigue and wear properties.
4. ArmaSteel responds to selective hardening by any of the commercial processes, such as induction, flame-hardening or bath immersion.
5. ArmaSteel maintains its properties at sub-zero temperatures.
6. ArmaSteel may be machined and polished to the mirror finishes so necessary to reduce friction.
7. ArmaSteel can be cast to combine several parts in one integral casting, thereby reducing machining and assembly costs.
8. ArmaSteel can be heat-treated to cover a wide range of physical properties.

Leading manufacturers have proved ArmaSteel to be an exceptionally versatile material, adaptable to varied requirements and lending itself to time-saving techniques.

Investigate ArmaSteel. It may effect savings and improvements in your product. Write us, detailing your requirements. Specify ArmaSteel in your reconversion plans.

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SAGINAW, MICHIGAN

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VIBRATION!

**THE STOVER
SELF-LOCKING NUT
can "take it"!**

When you have tested this new-principle self-locking nut, you will understand the true meaning of vibration resistance. You will see a precision-made nut which has been transformed into a powerful, metal spring. You will see the natural elasticity of metal employed to provide a mighty grip that defies vibration.

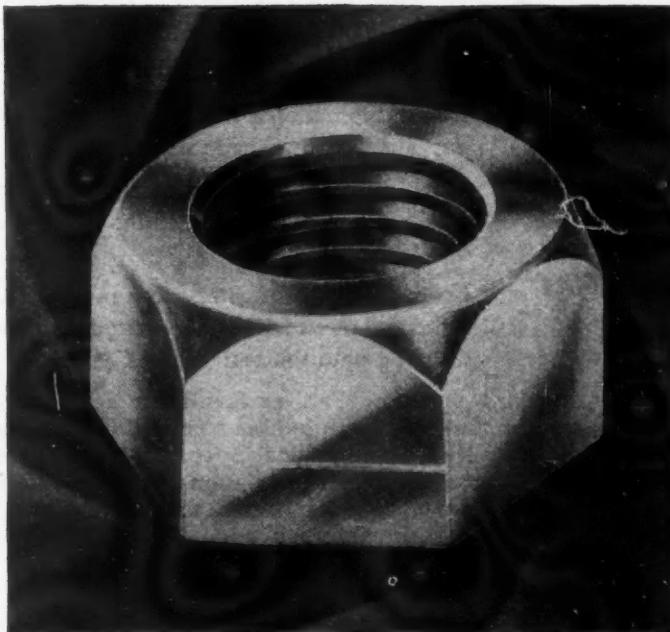
And yet the STOVER Self-locking Nut is a simple thing. It is in one piece with no complicated assembly. It does the whole job by itself. It locks at any point desired on the bolt and does no harm to the bolt threads. It can be used over and over without substantial loss of efficiency. It is made in standard sizes and threads from $\frac{1}{4}$ inch to $1\frac{1}{2}$ inches. Finally, it costs no more than older-type less efficient lock nuts.

Send for descriptive literature and samples.

STOVER
"IT WON'T SHAKE LOOSE"

**STOVER LOCK NUT
AND MACHINERY CORPORATION**

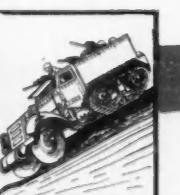
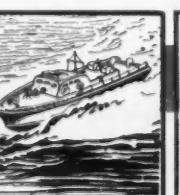
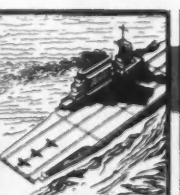
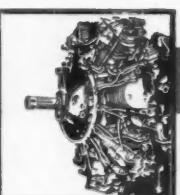
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REPRESENTATIVES IN PRINCIPAL CITIES.



PATS. PEND.

MEETS ARMY AND NAVY SPECIFICATIONS

The STOVER Self-locking Nut is eliminating the loosening effect of vibration on many machines of war. Study it in relation to your postwar planning.





Felt, insulator par excellence for aircraft in this global war, was called on for EXTRA service.

THE PROBLEM

Could this material be made flame-proof for any airplane application?

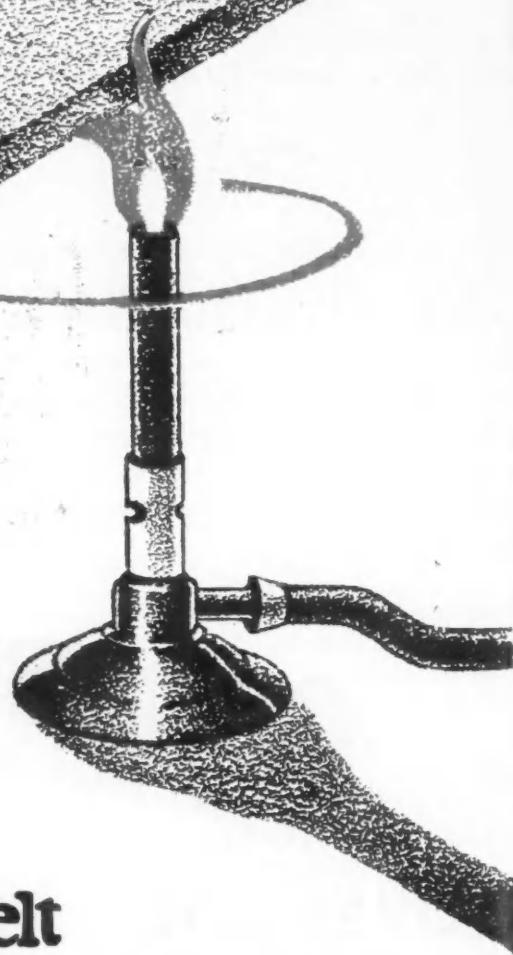
THE TEST

Felts chemically treated by American Felt engineers were exposed to the direct flame of a bunsen burner.

THE RESULT

No combustion or after glow resulted after removal—even when pure oxygen had been directed onto the tested area!

Any standard, specified Felt, as S.A.E. for example, can be delivered flame-proofed to meet standard specifications such as Army-Navy Aeronautical Spec. AN-S-32. In industrial and automotive, as well as aviation installations where fire resistance is a factor—look to Felt to serve as faithfully as in its many other protective functions. Write for samples, Technical Data Sheet # 12, and—"The Story of Felt."



**American Felt
Company**
TRADE  MARK

General Offices:

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Sales Offices at New York, Boston, Chicago, Detroit, Philadelphia, Cleveland, St. Louis, San Francisco, Dallas, Seattle, Los Angeles

PRODUCERS OF FINEST QUALITY FELT PARTS FOR OIL RETAINERS, WICKS, GREASE RETAINERS, DUST EXCLUDERS, GASKETS, PACKING, VIBRATION ISOLATION, INSULATION AND SOUND ABSORPTION FELTS



Sea Level Power 12,000 Feet Up

B-W SUPERCHARGED ENGINES . . .

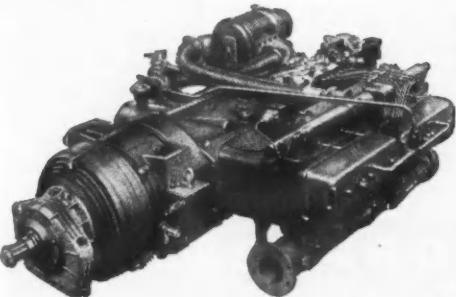
Pull These Motorailers Over The Andes

Faster acceleration from standstill . . . power to negotiate steep grades . . . sea-level performance at Bogota and points 12,000 feet up—these requirements were readily met by the twenty self-propelled rail cars delivered before the war to the Colombian Nat'l Railways.

Built by American Car & Foundry Company, these cars were driven by Waukesha-Hesselman engines supercharged with B-W (McCulloch) Superchargers.

Not only have these supercharged engines met all power demands of the motor rail cars with their trailers, but have also enabled these cars to take the place of unobtainable locomotives in hauling strings of freight cars.

Two of these horizontal type Waukesha-Hesselman six cylinder, electric-ignition engines, suspended under the floor, constitute the power plant of each rail car. Note supercharger in upper corner. It is driven by a V-belt from extension of the crankshaft.

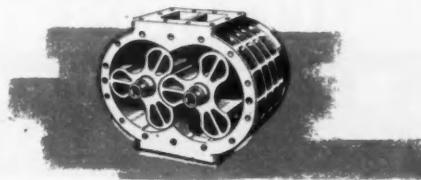


SUPERCHARGERS, Inc.
Formerly
McCULLOCH
ENGINEERING CORP.

• DIVISION OF BORG-WARNER

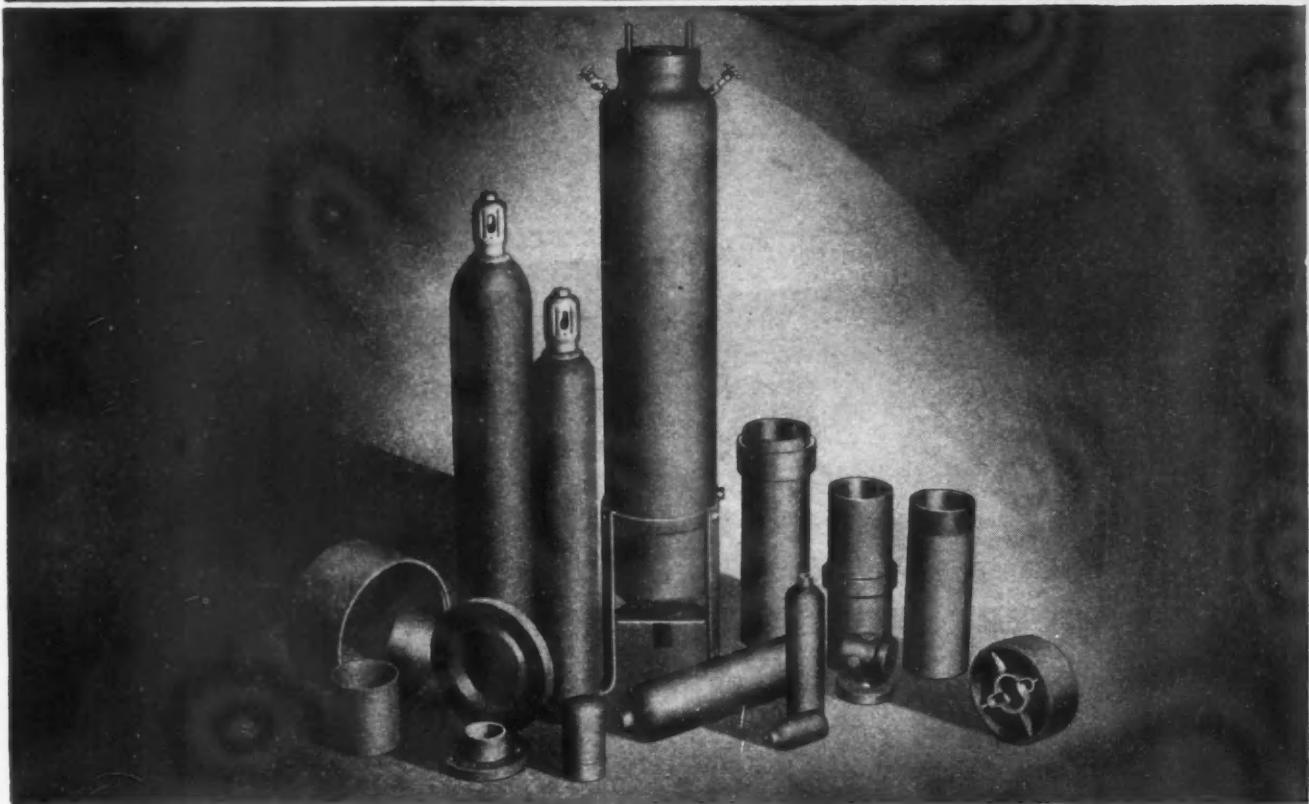
Milwaukee 9, Wisconsin

B-W Positive Displacement Superchargers supercharge at all speeds and in proportion to the need of the engine for air.



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HARRISBURG STEEL CORPORATION



The Harrisburg Steel Corporation is a self contained corporation with a plant covering over sixty acres and specializing in the manufacture of Seamless and Drop-Forged Steel Products among which are:

ALLOY AND CARBON STEEL, straight carbon regularly made from .08 to 1.50%, alloys in same carbon containing nickel, chromium, vanadium, molybdenum and manganese, meeting S. A. E. specifications and specifications of our customers.

SEAMLESS STEEL HIGH PRESSURE CYLINDERS for the transportation and storage of gases, liquids, etc. under high, medium or low pressures. They are plate-made.

SEAMLESS STEEL CO₂ LIQUEFIERS for converting solid CO₂ into liquid or gas. The closure, an exclusive Harrisburg feature, eliminates leakage at any pressure.

THE OIL-FIELD PRODUCTS are Seamless Steel Couplings for all kinds of pipe, Slush Pump Liners with gun-barrel finish and Drop-Forged Steel Pipe Flanges, both threaded and welding types. All sizes.

DROP-FORGINGS made by the drop-hammer method for use in the automotive, petroleum, railroad, marine and other industries.

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Contains official S.A.E. Standard Specifications: Information on Cylinders, Flanges, Couplings, Pump Liners: Up-to-date data on the Liquefier. Well illustrated. An important reference book to have in your possession.



HARRISBURG STEEL CORPORATION
HARRISBURG • PENNSYLVANIA



As long as they are needed, King-Seeley will continue to concentrate all its facilities and energy in the production of ammunition components and a variety of parts for combat vehicles, aircraft, landing barges and fire control systems.

BUT when G. H. Q. flashes the signal, this organization will, with renewed enthusiasm, resume its service to the automotive industry in the production of instruments, instrument clusters, speedometers, governors and oil filters.

Our reconversion has been carefully planned. It can be made promptly enough to prevent delays in the production of victory models in both automobiles and trucks.



KING-SEELEY
CORPORATION
ANN ARBOR  MICHIGAN

COST CUTTING IS EVERYBODY'S JOB

- ★ Most people are willing to pay a reasonable premium for extra quality. But nobody wants to pay a premium for needlessly high production costs.

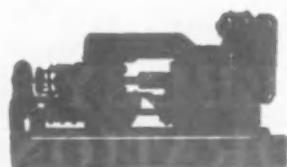
Because our national ability to produce is greater than ever before, everybody's business faces an era of competition in which better values and lower selling prices are sure to be key factors in success. Or for survival.

Acme-Gridley Automatics are a short cut to these lower selling prices for all products requiring precision metal parts.

These multiple spindle Automatics—Bar and Chucking Types—cut costs by the very simple process of producing more—in less time—without any sacrifice of uniform precision.

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BAR and CHUCKING AUTOMATICS
maintain accuracy at the
highest spindle speeds
and fastest feeds modern
cutting tools can withstand.

The NATIONAL ACME Company
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3808 Fountain Avenue, Lancaster, Penna.
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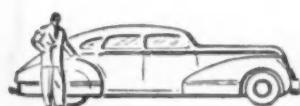
The remarkable effectiveness of the Inland-made Carbine—the light, maneuverable and deadly accurate little .30 caliber gun—has been proved in every theater of war.

Yet, when the war began it was only a design which normally would have been years away from finished production.

Inland's resourcefulness in carrying the Carbine from design to quantity manufacture in record breaking time has been widely recognized. In fact, the Carbine has been called one of the outstanding Ordnance developments of the war.

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INLAND MANUFACTURING DIVISION, General Motors Corporation, DAYTON, OHIO



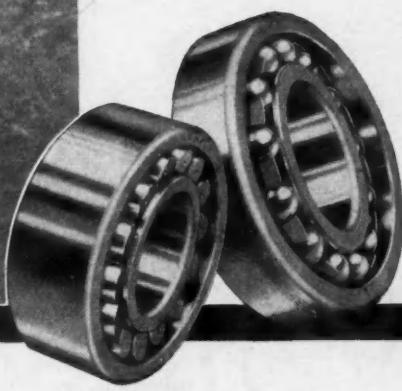
INLAND
Manufacturing
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Inland Products for Victory include Carbines, Tank Tracks, Gun Sights, Helmet Liners, Extinguisher Horns, and Rubber. Synthetic Rubber and Metal Parts for Tanks, Aircraft, Submarine Chasers, Torpedo Boats, Artillery Lighters and Landing Craft.



Photo courtesy
ATLANTIC REFINING
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Down go fleet costs with **SKF** Bearings

Low fleet costs start with bearings. That's why an **SKF** Bearing is being applied to this generator shaft of a 2500-gallon Mack Tank Truck. When the bearing is right, the generator performance is right, and so is the performance of the truck. Bearing dependability assures truck availability, long life, and low maintenance costs. Ask your mechanic. He knows.

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SKF
ball and roller bearings

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TITE SEAL always retains its plasticity and superb sealing qualities . . . never shrinks, cracks or crumbles . . . even in arctic or stratosphere cold.

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- NON-HARDENING
- IMPERVIOUS TO ACIDS, OILS GASOLINE, WATER, ETC.

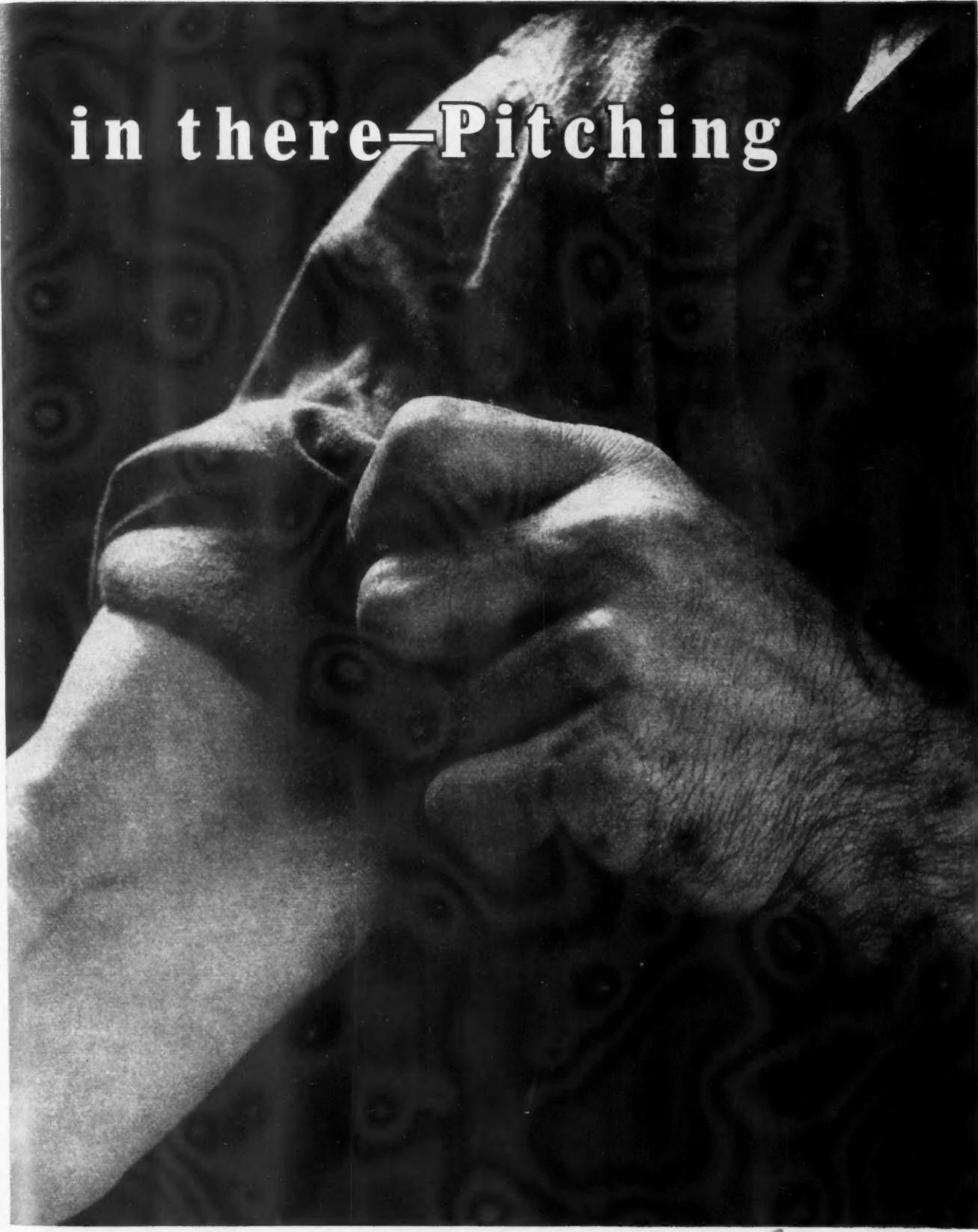
Over twenty years ago, **TiteSeal** revolutionized the gasket and joint sealing compound field by introducing its non-hardening feature. The non-hardening feature of **TiteSeal** makes it possible to disassemble a **TiteSealed** joint by a twist of a wrench . . . a most important advantage when emergency repairs must be made far from a service base and a valuable time saver under any conditions, without breaking joints . . . yet unconditionally insuring its leakproof performance. It has since served in all corners of the Earth, under all sorts of rigorous conditions, but has never been known to shrink, crack, crumble or to lose its grip or its leak-preventing plasticity.

TiteSeal is made in FIVE DENSITIES to meet every gasket and joint sealing need . . . from the most rugged to the most delicate. **TiteSeal** does an unsurpassed job of preventing leaks of liquids gases and pressure under the most severe conditions.

Brush-On Aviation Grade is available in $\frac{1}{4}$ pints, pints, quarts and gallons. The other densities in 2 oz. and 8 oz. tubes; 1 lb., 5 lb., and 25 lb. cans, and in 120 lb. drums.



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Every man on the job at Olofsson's knows what PRECISION means. They take pride in quality performance as designers and builders of tools, dies, jigs, gages, fixtures and special machines.

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TOOL AND DIE COMPANY
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SPERRY EXACTOR REMOTE CONTROLS in use!



**Positive
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through
a
single
tube**

The Sperry EXACTOR Hydraulic Remote Control is a simple, unique, single-tube system designed to control mechanisms over distances up to 200 feet. The more than 60,000 EXACTORS in operation today, solving the remote control requirements of design engineers in many fields, are proof of the thorough engineering and trouble-free design incorporated in this system.

It is accurate to a fraction of a degree and entirely self-contained, reproducing applied motion without the aid of an auxiliary source of power. It presents no installation problem, because both the Transmitter and Receiver are compact and light in weight, and the tube which connects them can be bent around obstacles easily. Vibration does not interfere with its positive, reliable action and means is provided for periodic temperature compensation.

If you have a remote control problem — in the railroad, marine, automotive, aviation, or any of the industrial fields — you will want our completely descriptive booklet. Send for it today.

The Sperry EXACTOR HYDRAULIC REMOTE CONTROL is rated at 400 inch-pounds in one direction, through 55° of motion, and 100 inch-pounds on the return.

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Gentlemen: Please send me, at no cost, a copy of your Bulletin 78-D containing complete details on your EXACTOR HYDRAULIC REMOTE CONTROL.

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HOBOKEN NEW JERSEY



HIGH SPEEDS

HIGH ALTITUDES

HIGH PRECISION

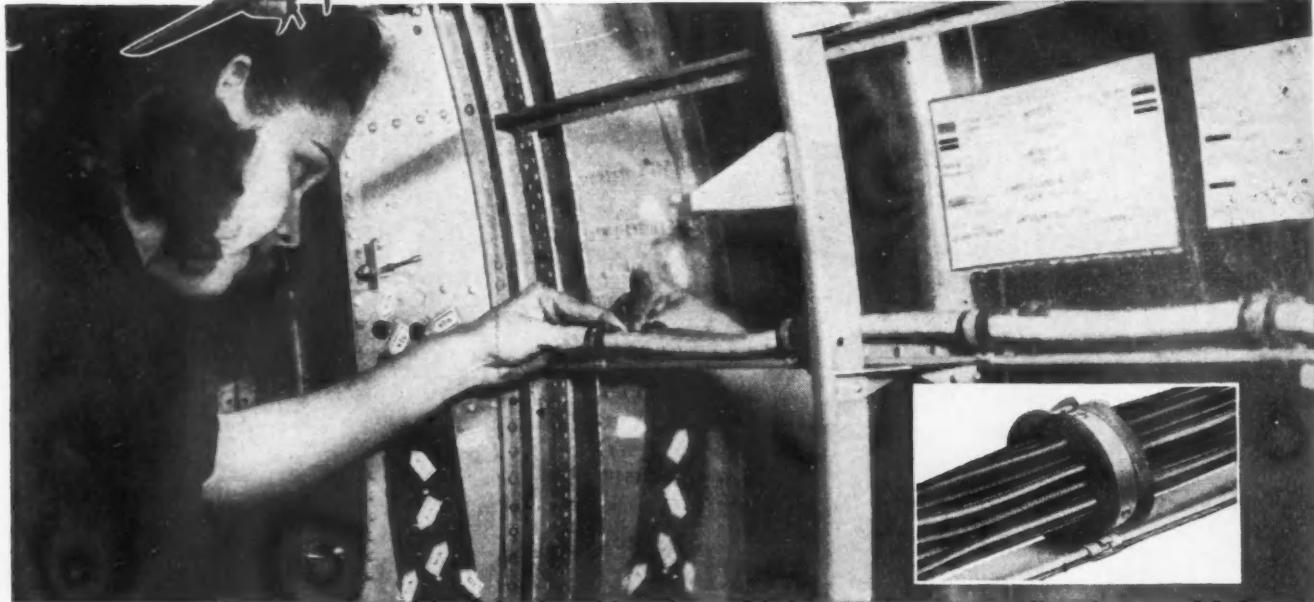
Precision beyond what the world thought reasonable when we started in business in 1906, has been demanded by the Aircraft Industry—for the best of reasons.

In our manufacture of **DOLE AIRCRAFT VALVES and FITTINGS** we never questioned—but straightforwardly met the extreme conditions of flight—and we expect to continue designing and manufacturing to the highest standards.

THE DOLE VALVE COMPANY • 1901-1941 Carroll Avenue • Chicago 12, Illinois
Los Angeles Detroit Philadelphia



Girl in bomber fuselage is tightening one of the hundreds of wire harness bands used on each Boeing B-29 Superfortress. Bands are supplied by United-Carr Fastener Corp. Each band is lined with cellular rubber, produced by Sponge Rubber Products Co., to cushion, insulate and prevent chafing. Parts are small—but they do a big job in protecting wiring against vibration of four 2200 h.p. motors and the recoil of Superfortress guns.



AVAILABLE NOW Specially Compounded for Automotive Use

We can accept your order now for sheet sponge rubber specially compounded for automotive use.

Resists gasoline, oil, and corrosive vapors, and abrasion. Supplied in sheets of any desired length, as hard or as soft as required. Use it to insulate, block sound transmission, cushion floors, line trunks, seal out moisture, dampen vibration. You can also have die cut pieces, molded parts, continuous strips or cords compounded to meet your special requirements. Tell us your problem; our staff, with long experience in serving America's leading automobile manufacturers, will help you solve it quickly, economically.



THE RUBBER COLLAR THAT TOOK THE 'RUB' OUT OF WIRE HARNESS

... A lesson in post-war progress from a Boeing Superfortress

The tiny strips of cellular rubber that cushion the hangers for wires in the B-29 Superfortress cost just a few pennies. But what a man-size job they do! They soak up vibration... prevent chafing... keep wires in condition to "keep 'em flying"!

Wherever there is a danger of vibration—in an automobile, an airplane, a railroad train, a machine tool, a home appliance—*any* motor-driven piece of equipment—similar applications of cellular rubber can lengthen the life of equipment; help assure trouble-free operation.

Two Basic Types Available

Our organization, with 21 years' experience compounding sponge rubber (Spongex*) also produces another basic type of *cellular rubber*—Cell-tite*. In Spongex, the most familiar type of this material, the cells inter-connect. In Cell-tite the cells are individual, separate, filled with inert gases.

Consult us *now* if you need any variety of cellular rubber. We are able and ready to help you solve any problem of sealing, cushioning, vibration dampening, sound deadening, insulating, and have ample production facilities to meet your present and post-war needs.

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Sponge Rubber Products Co.

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Sales Offices: NEW YORK • CHICAGO • WASHINGTON • DETROIT

World's Largest Manufacturer of Cellular Rubber Products

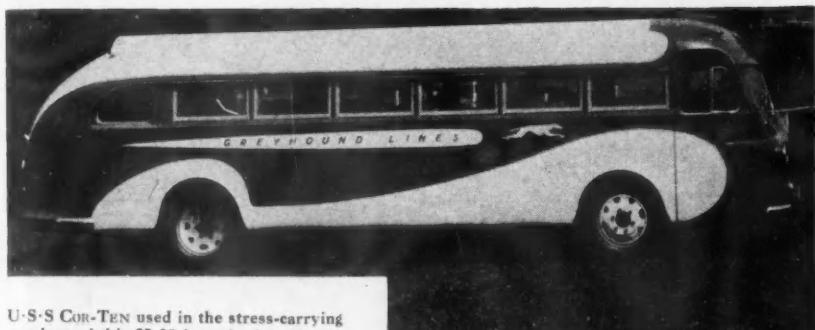
YOU BUILD FOR TOMORROW . . .

when you build light with COR-TEN

Bigger payload capacity
Lower operating costs
Reduced maintenance
Greater safety



The payload is the pay-off. In 40 lightweight semi-trailers like these, COR-TEN used in the body framing and in all stress-carrying members reduces deadweight 2600 lbs., provides 200 cu. ft. more carrying capacity, has materially increased the earning power of the fleet. COR-TEN's greater strength and elasticity increases resistance to metal fatigue, insures long life and uninterrupted service.



U-S-S COR-TEN used in the stress-carrying members of this 25-30 intercity bus assures maximum strength and minimum weight.

COR-TEN used in the body of this 16-yd. semi-trailer dump truck to insure greater strength and stamina, also saves 750 lbs. or 12.6% weight.



High Strength Steels

AMERICAN STEEL & WIRE COMPANY, Cleveland, Chicago and New York
CARNEGIE-ILLINOIS STEEL CORPORATION, Pittsburgh and Chicago
COLUMBIA STEEL COMPANY, San Francisco
NATIONAL TUBE COMPANY, Pittsburgh
TENNESSEE COAL, IRON & RAILROAD COMPANY, Birmingham
United States Steel Supply Company, Chicago, Warehouse Distributors
United States Steel Export Company, New York

BY trimming off useless deadweight to make room for more carrying capacity—by lightening the load on tires, brakes and motors—by adding strength, ruggedness and greater resistance to corrosion and wear, COR-TEN construction can put your equipment into the higher earning brackets. Keep this in mind as you plan for tomorrow.

Thousands of buses, trucks and tractors that during these war years have given outstanding performance, have proved the safety, the lasting qualities and economic soundness of lightweight construction with COR-TEN. The extra stamina that COR-TEN insures and the bigger payloads it makes possible have paid off, big.

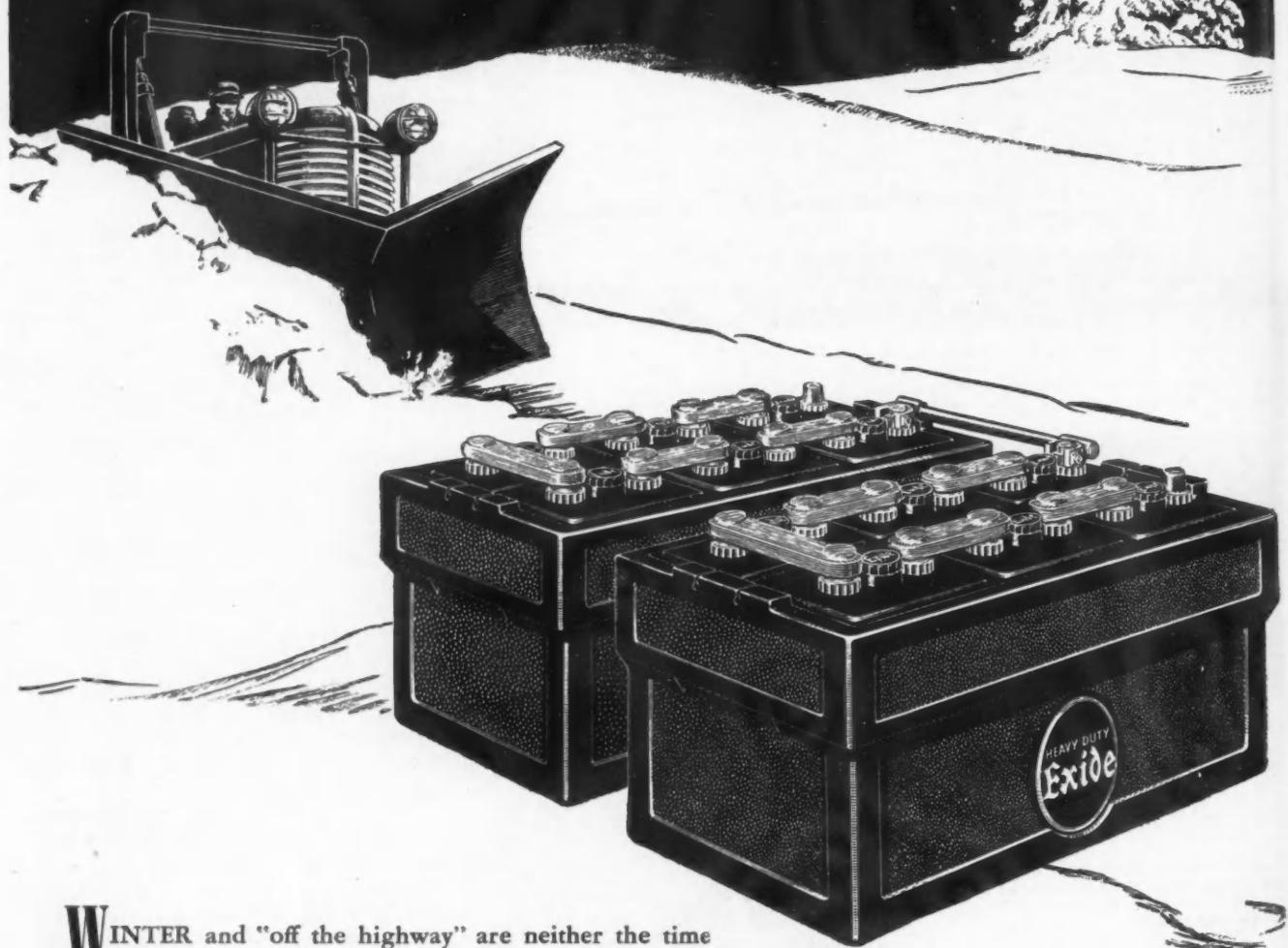
Now that COR-TEN is again available for such construction, plan to give your transport units the economic advantages that the proper use of this pioneer, high strength steel insures.

There is nothing experimental about COR-TEN. Fabricating techniques have been thoroughly established. The accumulated data of more than 10 years widely varied application is available to safeguard its use in your designs. COR-TEN construction squeezes out the highest profit return from weight reduction because COR-TEN trims off weight at lowest cost per pound saved.

Our engineers will gladly show you how and where COR-TEN can be applied to add safety and longer life to your equipment, to give it the ability to do more work, to carry bigger loads farther at less cost. When the postwar battle of transportation starts, you'll need these advantages.

UNITED STATES STEEL

When Diesel cranking is tough count on Exide



WINTER and "off the highway" are neither the time nor the place for panty-waist equipment. It's a combination that means tough going every foot and minute of the way. Only equal toughness can stand the heavy grind. Automotive engineering has met the issue with its mighty bulldozers, draggers and other husky workers. Exide engineering has kept pace with batteries of extra power and ruggedness.

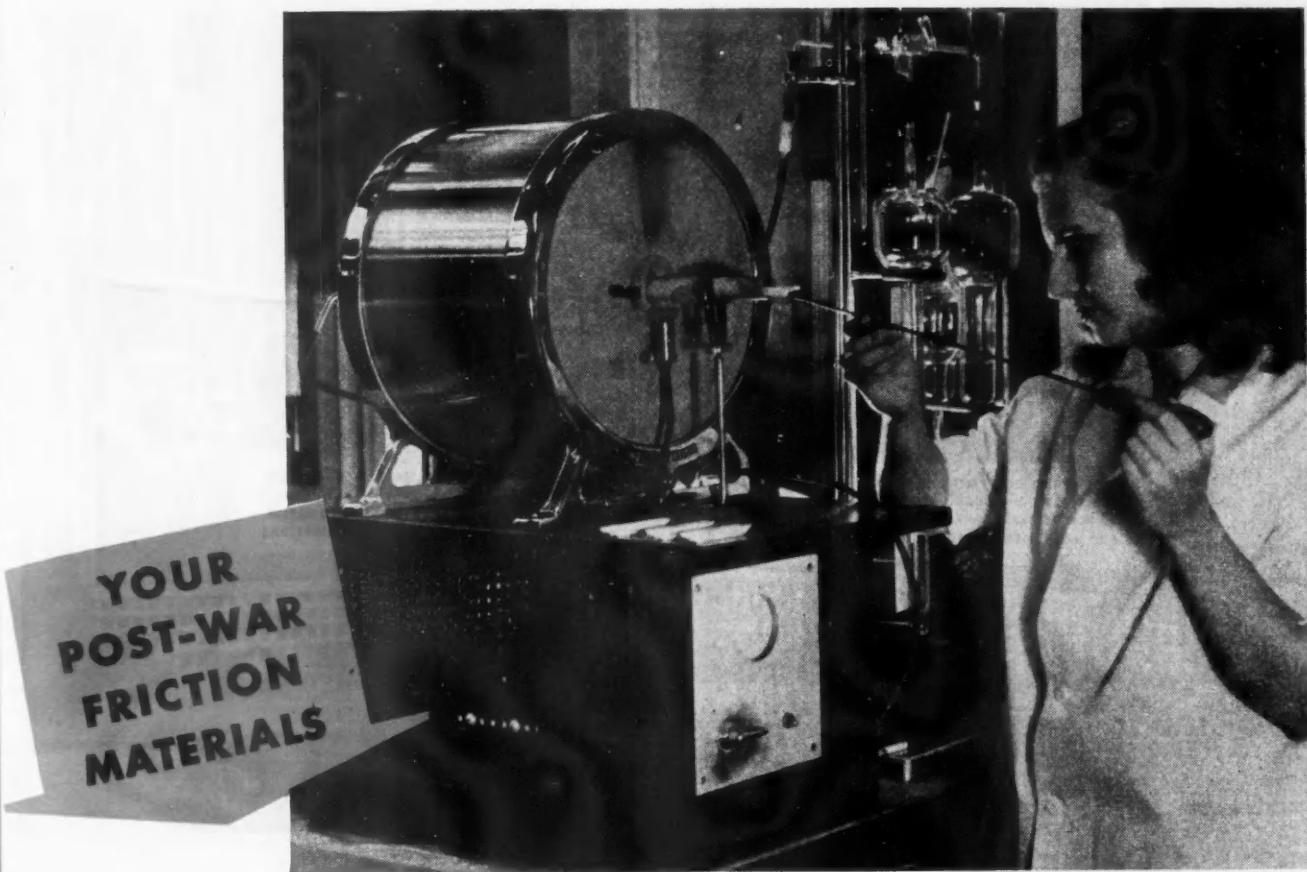
In all climates, in all parts of the world, on all sorts of jobs, Exide Heavy-Duty Batteries are showing that they can take whatever comes, give it all the power it needs, and keep it up day after day. They have the power to provide the high speed needed for Diesel cranking. And you can always count on your Exides for dependability, long-life and ease of maintenance.

Write today for a FREE copy of the Exide Catalog on Heavy-Duty Batteries. It gives you catalog data on how to order and how to get the most from your Exide Heavy-Duty Batteries.

SUPPORT THE 6th WAR LOAN
LEND OVER HERE, TILL
IT'S OVER, OVER THERE



THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32
Exide Batteries of Canada, Limited, Toronto



...are being perfected NOW!

MEASURING the exact amount of carbon in each Velvetouch formula, as shown in the photograph above, is only one of many controls by which we assure uniformity of quality. Our laboratories are engaged in never-ending research to improve still further the friction qualities of Velvetouch *all-metal* clutch facings and brake linings . . . so that you may safely specify Velvetouch for rugged, heavy-duty operating conditions in all types of industrial machinery.

THE S.K. WELLMAN COMPANY

1374 EAST 51st STREET • • • CLEVELAND 3, OHIO



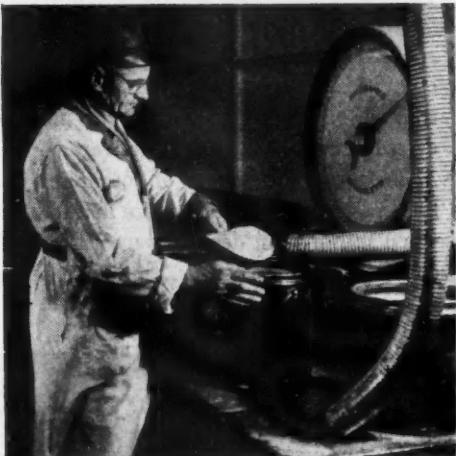
Velvetouch is *all metal*—a combination of powdered metals, compressed, sintered and welded to a solid steel backing.

For Brake and Clutch

... Use

Velvetouch

The "INSIDE STORY" of POWDER METALLURGY



CHAPTER 1. Powdered metals—iron, lead, tin, etc.—first are carefully blended in the right proportions for each type of brake and clutch. After thorough mixing, they are ready for the molding and sintering operations.



Signs of the Times

ATTITUDES on civilian production schedules change quickly, but one thing you can depend on, when "Signs of the Times" point to peace . . . Sprayit and Elesco products will satisfy your demands.

These products will come quickly too . . . simple reconversion problems . . . enlarged manufacturing capacities . . . mass production facilities . . . and a well trained organization will set in motion, complete cycles necessary for early delivery.

Never in the history of commerce has American business faced a condition like that to be encountered when full civilian demands are resumed. Orders will come from every corner . . . industry . . . stores . . . offices

...homes . . . everywhere. It is the purpose of Sprayit and Elesco to release a steady flow of merchandise to these markets, and the finest products we have ever produced.

An outstanding new line of paint spraying equipment, air compressors, spray guns, insecticide sprayers, air tools, sanders, and allied finishing equipment will be made available to leading jobbers by Sprayit. And a fine line of electric motors, generators, hydraulic cylinders, valves, pumps and controls for aircraft, automotive and other industrial applications, will be produced for manufacturers in these fields by Elesco. Your correspondence is invited.

ELECTRIC SPRAYIT CO.

SHEBOYGAN, WISCONSIN

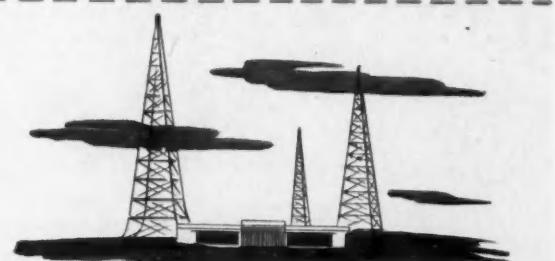
Electric Motors, Generators, Hydraulic Cylinders, Valves, Pumps and Controls for Aircraft, Automotive, and Other Industrial Applications.

Paint Spraying Equipment, Air Compressors, Spray Guns, Pumps, Air Tools, Insecticide Sprayers, Sanders and Allied Finishing Equipment.

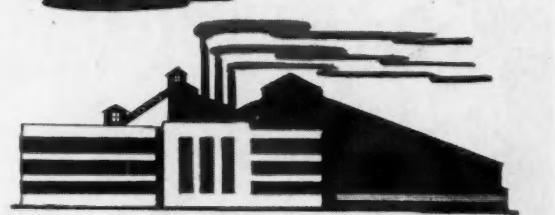
A Great Electronic Day...



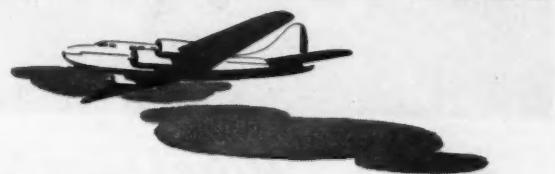
for Communications



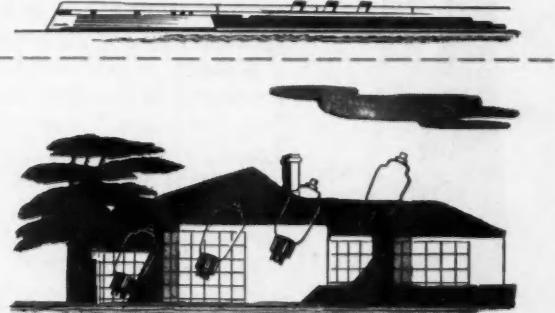
for Industry



for Transportation



for Home



Raytheon is proud of its contributions in the development of new electronic tubes and complete electronic equipment for the Armed Forces. Proud of the trust the military has placed in our designs, engineering and manufacturing abilities.

When war ends, Raytheon's wartime experience, research facilities, engineering and the production skills of over 16,000 men and women will be turned to peacetime electronics. Then you'll hear about and see Raytheon Electronic Equipment that will provide untold benefits in all phases of electronics. In the coming Age of Electronics . . . LOOK to Raytheon for complete electronic equipment and electronic tubes.

Tune in the Raytheon radio program: "MEET YOUR NAVY," every Saturday night on the entire Blue Network. Consult your local newspaper for time and station.



Devoted to research and manufacture of complete electronic equipment; receiving, transmitting and hearing aid tubes; transformers; and voltage stabilizers.



Wherever in the World your product goes from the assembly line, there goes with it your reputation . . . your responsibility for its peak performance in the field.

Vitally important to the quality and continuity of that performance is the ease and simplicity with which your job may be "un-buttoned" for adjustments and buttoned-up again for speedy resumption of operation.

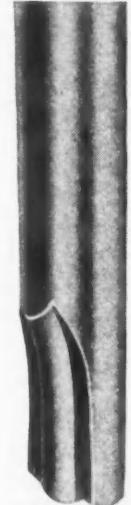
CLUTCH HEAD Screws, with their logical design for "screw-driver control" at all times, definitely dispenses of this field service problem. Only CLUTCH HEAD gives you this advantage because it is the *ONE* modern screw on the market specifically designed to be operative with an ordinary type screwdriver or any flat blade of reasonably correct width. Note that the thickness of the blade is secondary, the roominess of the Clutch permitting of a wide latitude in this respect.

This simplification of field service problems is just one of seven major features provided for safer and lower-cost production with better performance when you standardize your assembly on CLUTCH HEAD Screws.

Discover for yourself by personal test why this is The Screw That Sells Itself. Your request will bring you,

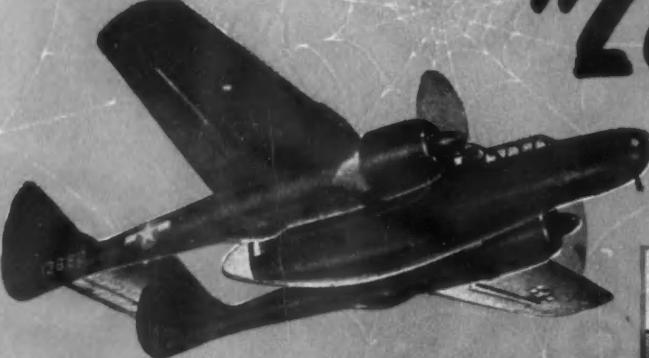


BY MAIL, a package assortment of CLUTCH HEAD Screws and sample Type "A" Bit; also illustrated brochure



UNITED SCREW AND BOLT CORPORATION
CHICAGO 8 CLEVELAND 2 NEW YORK 7

How the "Black Widow" uses "LUCITE"



Enclosures of Du Pont "Lucite"
methyl methacrylate resin sheets employed
on Northrop P-61 Night Fighter!

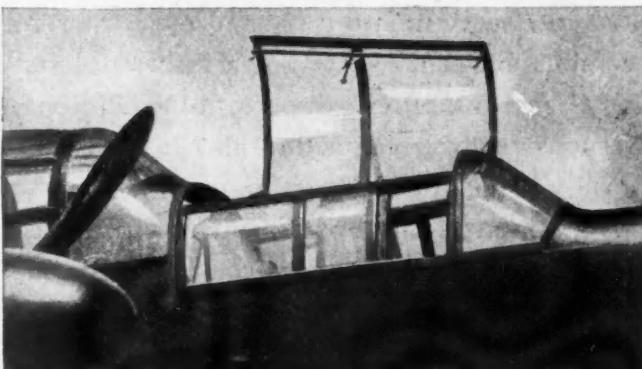
CRYSTAL-CLEAR transparency without distortion and excellent optical qualities are of utmost importance in the pilot housing and tail gunner compartment of a pursuit ship like the Northrop Black Widow. That's why Du Pont "Lucite" methyl methacrylate resin sheets are used for enclosures on this fast-flying, hard-hitting interceptor.

Colorless, transparent "Lucite" airplane sheeting surpasses Government specifications for optical uniformity—providing clear visibility. In addition, it has good shatter-resistance, high tensile and flexural strength, is light in weight and is not affected by the elements and by temperature changes.

Representative of other types of planes on which Du Pont "Lucite" has proved its adaptability, efficiency and economy are the Flying Fortress, Liberator, Lightning, Mustang, Mars and B-29 Superfortress.



Tail compartment of "Lucite" on the Northrop Black Widow. From this vantage point radio operator-gunner can ward off attack from above and below.



Pilot housing of "Lucite" provides clear side, top and forward vision for crew members of Northrop Black Widow.



LAMINATED "LUCITE"—"BUTACITE" SHEETING for pressurized plane enclosures. Free 28-page "progress report" is yours for the asking on your business letterhead. Provides technical information on proof tests, property graphs, and application. Address: E. I. du Pont de Nemours & Co. (Inc.), Plastics Department, Arlington, N. J. or 5801 S. Broadway, Los Angeles 3, California. In Canada: Canadian Industries, Ltd., Box 10, Montreal.



DU PONT PLASTICS

BETTER THINGS FOR BETTER LIVING...THROUGH CHEMISTRY

**In Your Post-War
Engine Design...**



MARKS THE SPOT

*...for provision of a direct governor driving outlet
—desired by many industrial engine users*

- Every month more and more internal combustion engines are going into industrial applications where dependable, efficient, responsive governing is desirable.

* * *

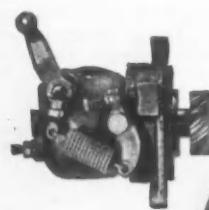
Every month, the orders roll in for Pierce Flyball Governors—because they give just that kind of performance. And many of those orders—from the engine users—are for the Pierce *universal type* governor which is driven by the fanbelt. This is an indication that many

engines in popular usage still do not provide outlets for direct governor drive by gear.

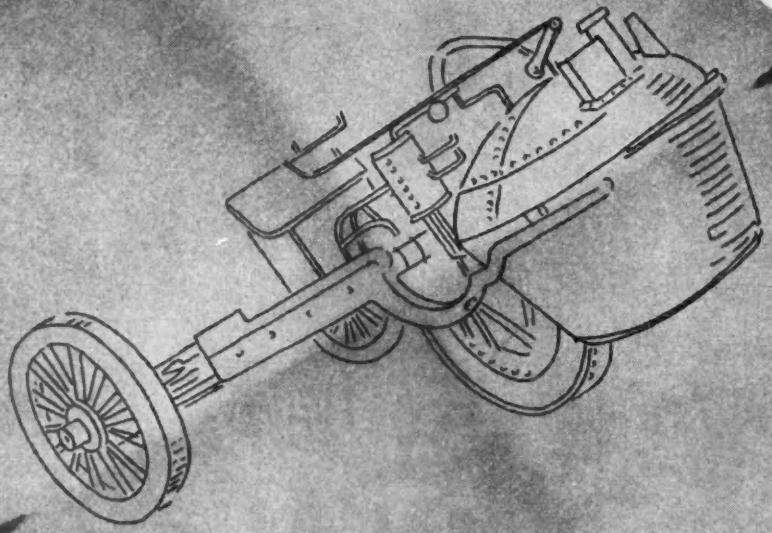
Wherever mechanically governed engines are in use, the operators express a definite preference for direct driven governors. There are a number of places on any engine where these desirable direct drive outlets may be provided—economically and easily. Pierce engineers, with a wide background in meeting and solving governing problems, are always happy to consult with engine designers to this end.

THE PIERCE GOVERNOR COMPANY, INC. • 1637 OHIO AVENUE • ANDERSON, INDIANA

Manufacturers of Pierce Precision Governors and Sisson Automatic Chokes



**PIERCE
GOVERNORS**



Experience Counts

That machine above was built by Nicholas Cugnot in 1769. It is the great, great, great grandfather of the modern automobile. Cugnot's machine was the original Stanley Steamer. It had a boiler in front and when it ran it might go as fast as 2½ m.p.h. That machine was a far cry from our modern car, but it was a fine idea. The reason it was not more successful was that Cugnot simply did not have enough experience.

In the manufacture of all products, Experience Counts.

The **WARD PRODUCTS CORPORATION** has long been a leader in the design and manufacture of antennas for automobiles and home radios. Many important design

changes, pioneered by **WARD**, have become accepted standards in industry. **WARD** products are quality products, reflecting the workmanship of craftsmen using modern equipment. . . . For the finest antennas for all automobile and home applications, look to **WARD**!

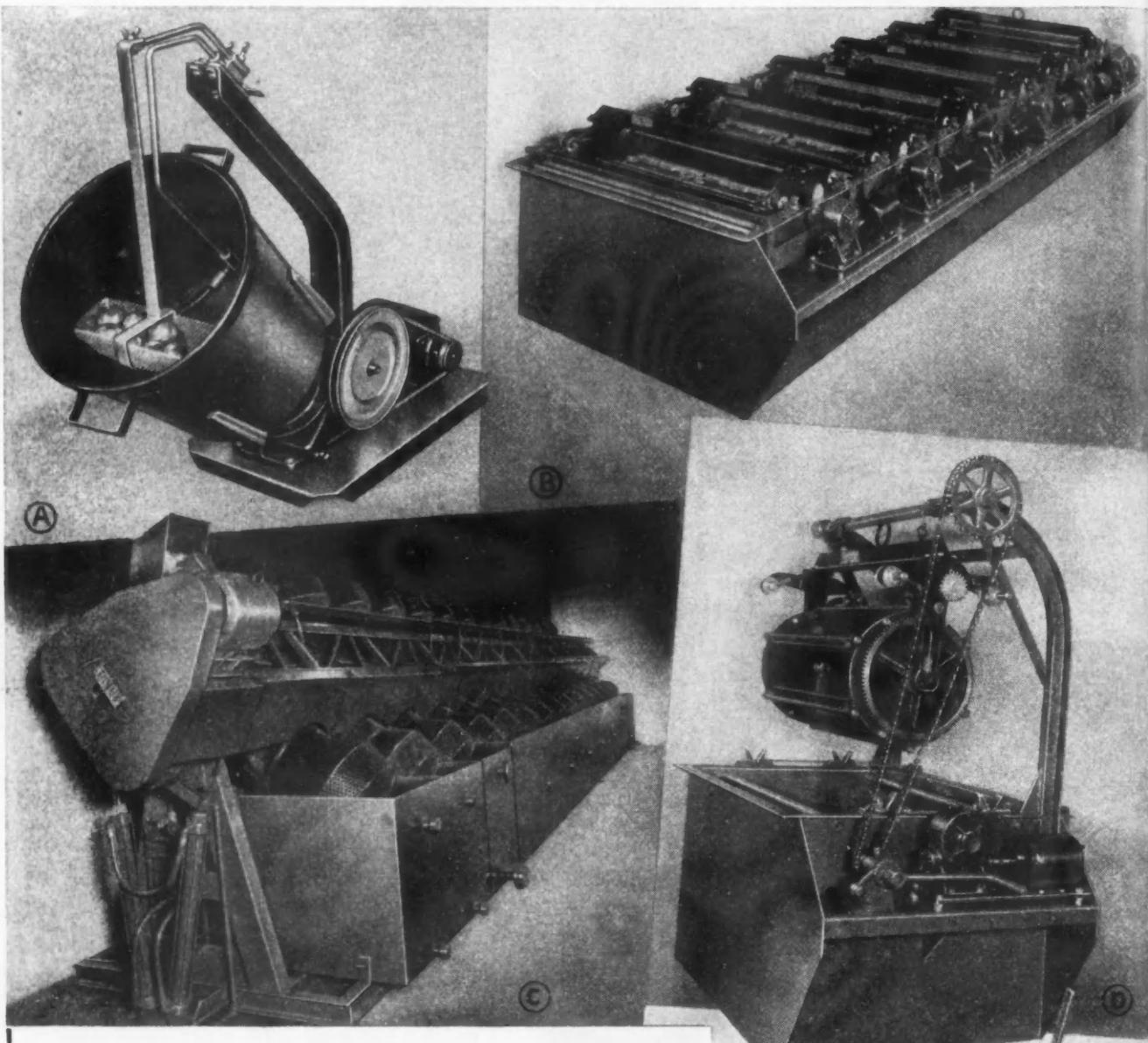


BUY
WAR BONDS



WARD
Antennas

THE WARD PRODUCTS CORPORATION
1523 E. 45TH STREET, CLEVELAND 3, OHIO



Specify UDYLITE Equipment for Bulk Finishing of Small Parts

In metal finishing equipment the name UDYLITE stands for the best. Udylite's complete line of equipment for the metal finishing plant is practical and dependable—designed by engineers who are thoroughly aware of the problems and requirements of the trade.

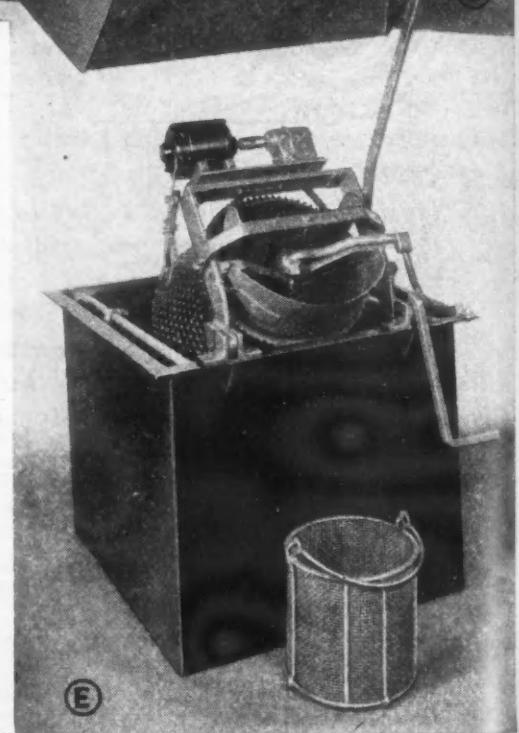
If you require specially designed equipment not found in our standard lines our experienced engineering staff will gladly help you work out the proper answer to your needs.

The respect for UDYLITE equipment is nationwide—the advantages of Udylite's unique "continuing service" in your own plant are worth your consideration.

Your inquiries are invited.

A. The Udylite Handiplater. B. Multiple Cylinder Horizontal Barrel.
C. Udylite Automatic Barrel Plating Machine. D. Udylite Horizontal Barrel with Hoist. E. The Udylite Multi Purpose Barrel.

THE UDYLITE CORPORATION
1651 East Grand Boulevard • Detroit 11, Michigan
Representatives in All Principal Cities



A complete WATER PUMP *service*

FOR YOUR NEW PRODUCT....

FOR IMPROVING PRESENT MODELS



Automatic SHAFT SEALS

for All Requirements

AUTOMOTIVE
and STATIONARY



Manufactured by

Schwitzer-Cummins will produce a FINE SEAL—a FINE IMPELLER—or a COMPLETE PUMP for you and all at a decided advantage in the performance of your product.

We have been specialists in the design and building of water pumps since the pioneering days of the automotive industry, and have actively participated in every era of the industry's development. We are the originators of the Automatic Shaft Seal and have developed it to its present stage of perfection. This long experience is yours for the asking. We invite your inquiries in the belief that we can not only be of assistance to you in your engineering problems, but can save you money as well.

You may want more water. You may have to reduce the space occupied by the pump. You may have a persistent leakage, or a dozen other troubles. Let us tackle the job. We will not take it as a matter of simply selling you merchandise, but as an obligation to obtain for you a highly efficient performance at a minimum of cost. We know so well the close relationship there must be between the seal, the impeller, and the pump itself if there is to be complete satisfaction.

You want either advantages in performance or price. We have both.



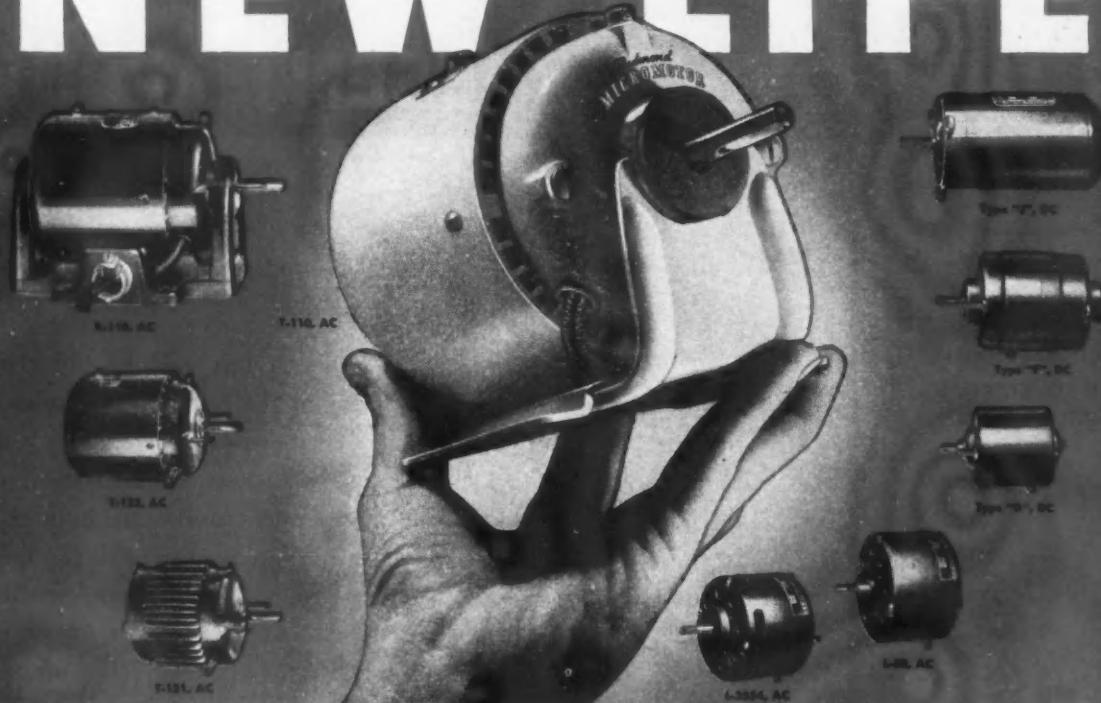
Send Today FOR OUR NEW CATALOG...
**THE STORY OF
AUTOMATIC SHAFT SEALS**
A SCHWITZER-CUMMINS DEVELOPMENT



SCHWITZER-CUMMINS COMPANY

INDIANAPOLIS, INDIANA, U. S. A.

NEW LIFE



FOR YOUR POSTWAR PRODUCTS...
Redmond MICROMOTORS

ADD new life to your products with Redmond Micromotors, built in sizes up to a tenth horsepower.

Add the revealing touch of experience—accomplishment by specialists—the magic of precision on a mass production basis.

Get the exclusive Redmond patents and

original Redmond developments. Take advantage of Redmond's 18 active years of effort concentrated on micro-power and its varied applications.

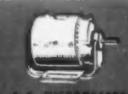
Learn all about these fine Micromotors, their long life, consistently low operating cost, and low first cost. *Write us today.*

Shaded Pole AC Micromotors are built in sizes up to 1/20th horsepower. Series and Shunt Wound DC Micromotors are built in sizes up to 1/10th horsepower for operation at 6 to 115 volts. Micromotors can be tailor-made to meet unusual requirements.

A. G. Redmond Company

Composite sketch of Redmond facilities
with over 5 acres of floor area.

OWOSO, MICHIGAN, U. S. A.



Matching PRESSES to FORCING Jobs

WHETHER YOUR SHOP schedule calls for forcing wheels, pinions, gears, bearings or bushings on axles or shafts... or removing them, once they're pressed on... or for other similar assembly or dismantling jobs... you'll find your answer in the wide-ranging line of Watson-Stillman Forcing Presses. Some of these units perform a large number of these operations with but slight adjustment. Others, as is evident from their design and construction, are made for more specialized functions.

These presses range from small compact units to large tonnage machines for handling heavy work on a traversing platform. Each is self-contained, quick-acting and oil-operated. Each performs its forcing operations smoothly, with a minimum of shock and maximum freedom from pulsation under pressure.

Only a few of the many available types and sizes of W-S Forcing Presses are shown here. Write for detailed information on these and other W-S Hydraulic Presses for forming, forging, flanging, straightening, shearing, piercing, bending, assembling, and other metal-working operations. Send for General Bulletin 110-A. The Watson-Stillman Co., Roselle, New Jersey.



6541

December 1, 1944

When writing to advertisers please mention AUTOMOTIVE and AVIATION INDUSTRIES

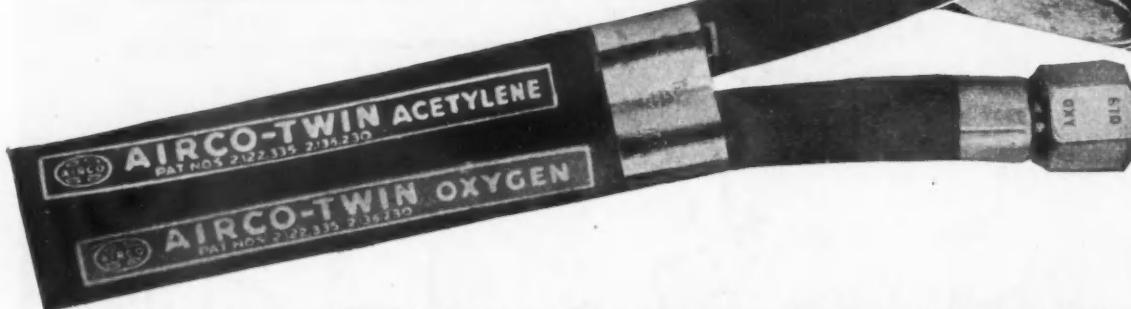
169



DON'T LET TANGLED HOSE
REDUCE SAFETY AND EFFICIENCY

PLAY SAFE!
Specify
AIRCO-TWIN

THE MODERN "2 IN 1" HOSE
FOR WELDING AND CUTTING



INCREASE the safety and efficiency of your welding and cutting operations by using Airco-Twin Hose. This modern hose is actually two separate lines molded into a single flexible unit.

Airco-Twin Hose is strong and will withstand pressures many times greater than those required for welding and cutting operations. For easy identification in coupling, the acetylene line is red and the oxygen line is black.

OPERATORS PREFER AIRCO-TWIN HOSE BECAUSE:

- (1) It does not kink as do individual lines of hose.
- (2) It can easily be shifted about—less chance of entangling with other objects.
- (3) Compact—it is easier to keep out of the way of hot slag and sparks.
- (4) Saves time required to tape up individual hose lengths.

A further description of Airco-Twin Hose is available in our folder ADC 609-A. It can be obtained from the nearest Airco office, or if you prefer, address your inquiry to Department AA, at the New York office.

★ BUY UNITED STATES WAR BONDS ★



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General Offices: 60 EAST 42nd STREET, NEW YORK 17, N. Y.
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COHRE *Conductive Wire* GASKETS

A
N INGENIOUS PRESSURE

sealing gasket (patent applied for) that also conducts high frequency currents.

This wartime development, widely used to ground high frequency currents built up in various rotating parts, holds promise for many peacetime applications.

If you have a problem involving the dispersal of high frequency or static through a pressure sealing gasket, one of our engineers will be glad to call and discuss it with you.

Also

Precision Molders
of many other
parts of synthetic
soft rubber to meet
close specifica-
tions now called
for by the Air
Corps.

THE CONNECTICUT HARD RUBBER CO.

423 EAST STREET, NEW HAVEN, CONN.

Custom Rubber Molders Since 1920

stockades used cross-bars...



BUT NEW PRODUCTS
NEED NEW FASTENINGS

To bring out the best in those new designs, you may need a fastener that has yet to be invented . . . a fastener that enables your product to do a better job.

Millions of Camloc quick-acting fasteners serve the aircraft industry on all fronts. Camloc designs fasteners to fit precise needs, and the accumulated knowledge and valuable experience that solved aircraft's fastener problems is at your service.

Whether you plan to make radios or vacuum cleaners, automobiles or washing machines, you'll find Camloc has much to offer.

CAMLOC
CAMLOC FASTENER CORPORATION



© Camloc Fastener Corp.

420 LEXINGTON AVENUE, NEW YORK 17, N.Y.

Tight, Permanent Solder Bonding

Demands
**CORRECT
FLUX**



Photo courtesy Bell Aircraft Corporation

Be Sure with KESTER

• Wrong flux can impair any soldered connection. Don't take chances with your finished product because the flux you use isn't suited to the job. Be sure with Kester!

• Forty-five years' experience backs Kester Fluxes. From that experience Kester engineers have developed a vast range of flux formulas covering every possible soldering requirement. Seams of various types require different kinds of flux. Spot soldering other kinds. Sweating operations still other formulas. And so on.

• What fluxes are best for your various soldering operations? Kester engineers and technicians can tell you. And the complete line of Kester Fluxes includes the right fluxes for your various jobs.

• Delicate electrical connections, for example, demand a flux that is a poor conductor, that is non-corrosive, and that has no tendency to collect moisture, dust or other foreign matter. Kester has it; and any other flux you need.

• Take advantage of Kester experience and Kester technical knowledge. Kester engineers will be glad to work with you. Consult them.

★ BUY WAR BONDS ★

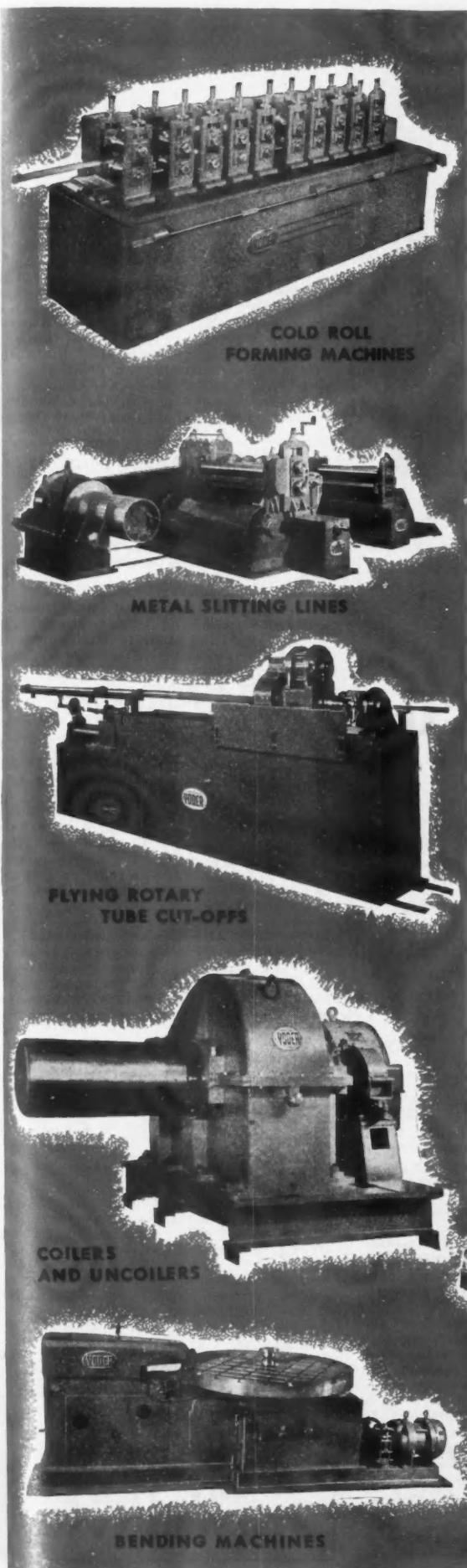
KESTER SOLDER COMPANY
4202 Wrightwood Ave., Chicago 39, Illinois

Eastern Plant: Newark, N.J.
Canadian Plant: Brantford, Ont.



KESTER
Solder Fluxes
STANDARD FOR INDUSTRY

for PRODUCTION of Many Things— ... Including Profits



YODER metal forming machinery for more than a generation has been engineered and built for an industry in which high production and low unit cost are basic requirements.

Thus YODER equipment helps solve the puzzle with which production men are struggling in these changing times . . . how to cope with the increasing significance of finished cost in the face of higher wage standards, difficult material supply and a demand for not-less-than-prewar quality in higher-than-prewar quantity.

"Increased production efficiency" is the cry. Illustrated here are a few of the versatile machines YODER manufactures for the exact purpose of increasing efficiency in the production of . . .

Cold-roll-formed sections of every variety . . . from light mouldings to heavy gauge angles, channels, and special structural sections . . .

Cold-formed and welded tubing from $\frac{1}{4}$ " to 24" or pipe from $\frac{1}{2}$ " to 24", for which YODER can supply a production mill complete to the last detail, or any part thereof . . .

Strip metal handling . . . coiling, uncoiling, slitting, leveling, trimming, de-burring, power-hammer forming, cutting off . . .

Plus complete engineering service for the adaptation of these lines or development of special machinery for your particular metal forming requirements, all based on well established awareness that . . .

YOU, TOO, MUST ENJOY A PROFIT

Write for new book on Yoder Production Equipment

•
THE YODER COMPANY
5500 Walworth Ave. • Cleveland 2, Ohio

A large, complex industrial machine used for forming and welding metal pipes. It features a long horizontal worktable, multiple forming dies, and a large cylindrical component for welding.

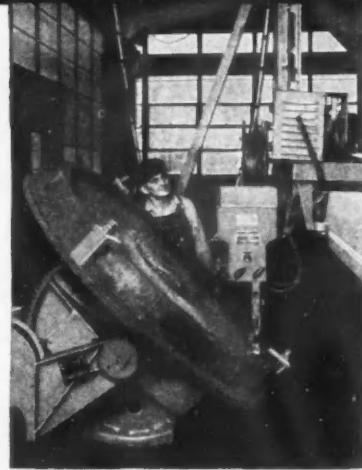
**COMPLETE
COLD ROLL FORMED
RESISTANCE WELD PIPE MILLS**

C-F POSITIONERS



When "Position" Counts Most

On automatic welding jobs, like the one illustrated here, position counts "most," and with the C-F Positioner (with 6 sizes, and capacities to 30,000 lbs.) the tables tilt to 135° beyond horizontal and rotate 360°, all under push button control. The exclusive C-F Variable-Speed Control gives table rotations ranging from 0 R.P.M. up for all sizes. For "quick change" of position, for greater time saving and efficiency, for lower costs



and greater safety to men and materials, specify C-F Positioners for all *automatic* and production welding operations.

Write for Bulletin WP-22

CULLEN-FRIESTEDT CO.

1322 S. Kilbourn Ave.

Chicago 23, Ill.

Personals

(Continued from page 54)

Edward C. Quinn. Other regional managers are Mark M. Whipple, Boston; Leslie W. Neumann, St. Louis, Mo., and J. W. McLaughlin, Cincinnati.

Capt. R. T. Brohead, U. S. N., retired, and **Richard P. McMahon** have been elected vice-presidents of the McAleer Manufacturing Co.

Galen C. Cartwright has been appointed manager of the sales promotion department of Goodyear Tire and Rubber Co.

The Carpenter Steel Co. has announced the following personnel changes: **John W. Moxon**, formerly with the Guaranty Trust Co. of New York, has been elected secretary-treasurer to succeed the late **Joseph S. Pendleton**. **Willard E. Roberts**, formerly with Lybrand, Ross Bros. & Montgomery, has been named controller. **Paul B. Greenawald** has been made general superintendent of mill operations and **George V. Luerssen**, assistant chief metallurgist.

Leonard C. Truesdell, formerly sales manager of Crosley Corp.'s radio and appliance division, has been appointed general sales manager for Bendix home radios. **Bendix Radio Div.** of Bendix Aviation Corp.

H. Webster Crum has been appointed manager of the new products div. of Good year Aircraft Corp.

The Watson-Stillman Co. has appointed **John Thomas Gillespie, Jr.**, manager of export sales.

The appointment of **J. E. Reagon** as director of sales and service has been announced by The Elco Lubricant Corp. He was formerly general service manager of the Timken Roller Bearing Co.

Clarence L. Collens, for 37 years president of The Reliance Electric & Engineering Co. has been elected to the newly-created post of chairman of the board and

is succeeded in the presidency by **James W. Corey**, sales vice-president since 1940.

The appointment of **George H. Strock** as regional manager of the newly established Australasia-South African Region, has been announced by **C. B. Thomas**, president of Chrysler Export Div., Chrysler Corp.

Globe Steel Tubes Co. has announced the appointment of **Frederick K. Krell** as advertising manager, with headquarters in Milwaukee.

Automotive Gear Works, Inc., has announced the appointment of **H. T. Sturgeon** to the position of sales manager.

R. W. Davis has been appointed general manager of the Allis-Chalmers Mfg. Co.'s Norwood, Ohio, works.

W. T. McCargo has been appointed Eastern Regional Sales Manager of the Carborundum Co., succeeding **F. Jerome Tone, Jr.**, who has been named vice-president in charge of sales.

F. Cyril Greenhill was elected president and assistant treasurer of the Acklin Stamping Co., Toledo. He succeeds the late **Frank E. Graper**, former president.

Aircraft Accessories Corp. has named **William Cook** vice-president in charge of production of the company's power controls div., Burbank, Cal. He was formerly director of industrial relations.

Standard Oil Co. of Indiana has announced the following personnel changes in the company and its subsidiaries, effective Jan. 1, 1945: **Edward G. Seubert** will retire as president. He will remain a director and become chairman of the executive committee of the board. **Robert E. Wilson**, now president of Pan American Petroleum and Transport Co., will become chairman of the board and chief executive officer of the Indiana Company and **A. W. Peake**, a vice-president, will advance to the office of president. His place will be filled by **F. O. Prior**, now president of Stanolind Oil & Gas Co. Mr. Prior will be a director and vice-president of the Indiana company

and will also be chairman of the board of the Stanolind Oil & Gas Co., Stanolind Pipe Line Co. and Stanolind Oil Purchasing Co.

The Udylife Corp. has announced the appointment of **L. V. Nagle** as vice-president in charge of national sales for the company.

Ethyl Corp. has announced the return of **George Krieger**, in charge of rural marketing and special development work as assistant to **Julian J. Frey**, general sales manager. Since 1942 Mr. Krieger has been with WPB.

The Timken Roller Bearing Co. has appointed **J. Ringen Drummond**, experimental engineer, as assistant factory manager.

Aro Equipment Corp. has announced the appointment of two new division managers as follows: **Ralph E. Lockhard** has been made lubricating equipment div. manager for the Chicago territory and **Ralph E. Wilkinson** manager of the lubricating equipment div. for the Wisconsin territory, with headquarters at Milwaukee.

Du Pont company has announced the following personnel changes: **Matt Denning**

Classified Advertisements

WANTED: Motor Truck engineers—designers—draftsmen. Openings with Eastern concern, offering permanence and advancement. Box 15, Automotive and Aviation Industries, Chestnut & 56th Sts., Philadelphia 39, Pa.

WANTED DESIGN ENGINEER, familiar with hydraulic mechanisms, by large manufacturer of lifting jacks in Middle West, to head up engineering of complete line of hydraulic jacks. Excellent opportunity, good salary, permanent. Give age, experience, salary in writing Box 18, Chilton Co. All replies confidential. Statement of availability required.

WANTED TRUCK BODY DRAFTSMEN Eastern Truck Manufacturer wants truck cab and body draftsmen, both detail and layout, experienced in full size cab and sheet metal design. Offer permanent connection for post-war. W.M.C. regulations apply. Include background and experience record in reply. Address reply to Box #19, Chilton Company, Chestnut & 56th Sts., Philadelphia 39, Pa.

TOOL DESIGNERS AND PRODUCTION ENGINEERS. Tremendous war use of our standard products requires immediate expansion of our facilities for small electric motor production. Product changes and process improvements contemplated to meet growing backlog of civilian requirements insure continuous positions. Location Central Michigan in town having 16,000 population. In your reply give record of your training and accomplishments. Salary open. Statement of availability required. Box 20, Chilton Company, Chestnut & 56th Sts., Philadelphia 39, Pa.

ENGINEERS AND DRAFTSMEN—SMALL MOTORS. Modifications to our peacetime products for increased war applications insure an interesting and valuable future with a company having an excellent prewar production reputation. Location Central Michigan in town having 16,000 population. In your reply give record of your training and accomplishments. Salary open. Statement of availability required. Box 21, Chilton Company, Chestnut & 56th Sts., Philadelphia 39, Pa.

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Proven Performance

FOR

SPECIFY CURTIS

Universal joints play an important part in the operation of airplanes and machine tools.

Where out-of-line transmission of power, or rotation of shafting around corners or at angles is necessary—strains and wear on universal joints working at such angles are excessive.

Engine controls — retractable landing gear — auxiliary power controls and elevator spars must have smooth, positive operation for the pilot and his crew.

In machine tools too — failure of any part means loss of production and costly repair shutdowns of multiple drill presses, grinders, milling machines, etc.

Curtis Universal Joints, made to Curtis "Standards" have PROVED their ability to "take it." The rigid Army Air Corps Class 1 specifications for strength and toughness are met and surpassed by Curtis Joints.

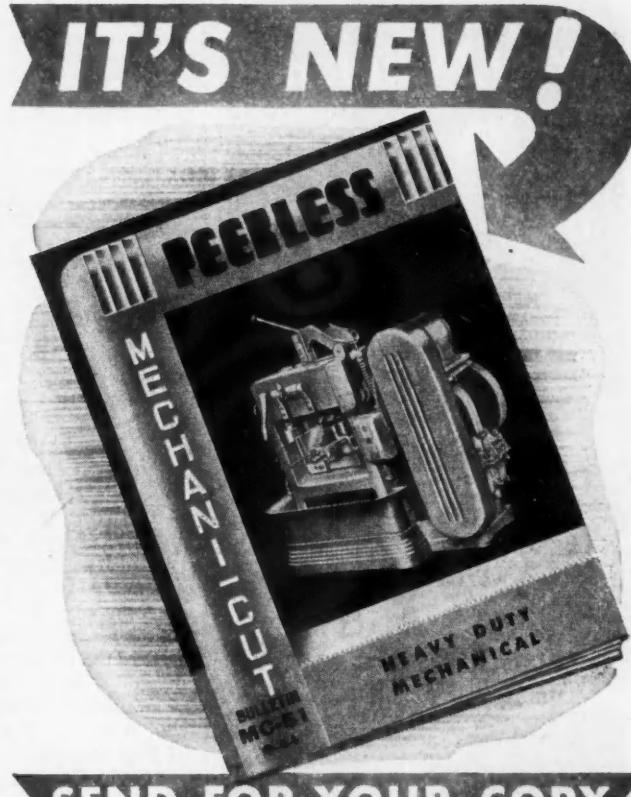
Through years of experience Curtis applied special steels and developed proper heat treatments to secure maximum strength and toughness. Accurate machining and fitting to close tolerances gives smooth, free-working surfaces — Curtis oilers insure proper lubrication — and the patented "Tell-tale" lock ring tells at a glance that each part is firmly locked together and permits rapid disassembly and reassembly in the field.

All these plus magnaflux inspection by certified operators give Quality Control thruout production.

Specify Curtis Universal Joints in any of their 14 sizes—let Curtis Engineers work with you on your problems — be sure of "Proven Performance."

On the Ground

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JOINT CO. INC.**
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THIS new Peerless Bulletin MC-51 fully describes the new Mechani-Cut. It is a precision-made, mechanically-driven metal cutting saw that sets new standards — in fast sawing, modern design, low maintenance and dollar-for-dollar value. Available in three popular sizes — 7" x 7" . . . 11" x 11" . . . and, 14" x 14".

Four-Sided Saw-Frame Finger-Tip Pressure Control

The new Mechani-Cut has the patented Peerless Four-Sided Saw-Frame that surrounds the blade and the work. Backing-Plate Blade-Support, locked 1/32" above blade, permits maximum blade pressure, assures positive lift clear across on the non-cutting stroke and maximum blade life.

New Compensating Feed Unit permits adjusting cutting pressure to the fraction of a pound.

The coupon will reserve your copy of the New Bulletin MC-51.

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- As a work table—always at proper height for each workman.
- Places and holds heavy work exactly where needed for machines.
- Loads and unloads motor truck shipments—level loading at truck or platform — transfers at places where overhead systems can't reach.

For the complete details of this adaptable, labor-saving cost-cutting, truck, write today for Bulletin 136. It's free for the asking.

LYON-Raymond Corporation
Material Handling Equipment
395 Madison St., Greene, N. Y.

has been appointed director of sales of the finishes div. He succeeds the late W. Franklin Donohoe. H. R. Lounsbury, eastern trade sales manager, finishes div., has been made refinish sales manager at the Wilmington office. J. L. Masterson, southwestern sales manager of the finishes div., has been transferred to the Wilmington office and will be succeeded in Dallas by J. W. Cleveland, asst. sales manager.

David M. Salsbury has been elected vice-president and general manager of the Westinghouse Electric Supply Co., subsidiary of Westinghouse Electric & Mfg. Co. Westinghouse has also announced the appointment of Clyde A. Peterson, of Chicago, as designer in the newly created Radio Receiver Div. of Westinghouse Electric & Mfg. Co.

Obituary

W. Franklin Donohoe, 54, director of sales of the Finishes Division, E. I. du Pont de Nemours and Co., died suddenly Nov. 10 while on a visit to Chicago to attend a meeting of the Refrigeration Institute.

Dudley H. Miller, 74, president and director of Speer Carbon Co., International Graphite & Electrode Corp., and Speer Resistor Corp., died Nov. 8 at his home in St. Marys, Pa.

William R. McPhail, 43, assistant to the Atlantic Division traffic manager of Pan American World Airways, died suddenly Nov. 13. He succumbed after fighting a minor fire at his home in Larchmont, N. Y.

George M. Graham

George M. Graham, at one time vice president of Pierce Arrow, Chandler Motor Car Co., and of Studebaker Corp., and a member of the board of directors of the Automobile Manufacturers Association from 1925 to 1927, died at Miami, Fla., Nov. 15, following an operation. Mr. Graham, who had been active in studying taxation problems while a member of the AMA board, had been retired in recent years.

Undersize Rod Pins Salvaged by Freezing

An estimated 16,000 undersize rod pins have been salvaged by a new freezing process in use at the Aircraft Engine Plant of the Ford Motor Co. and experiments in "growing" other parts have yielded promising results that probably will lead to widespread use of the method.

Pins that are two or three one-thousandths undersized are "grown" to proper dimension by cooling them to a temperature of -313° in liquid air. Actual "growth" takes place on the outer surface of the metal because of a change in the physical properties of austenite—a constituent present in varying quantities in most alloy steels. Under conditions of extreme heat or cold, austenite breaks down into martensite, an element of greater bulk, which increases the size of the part under treatment.



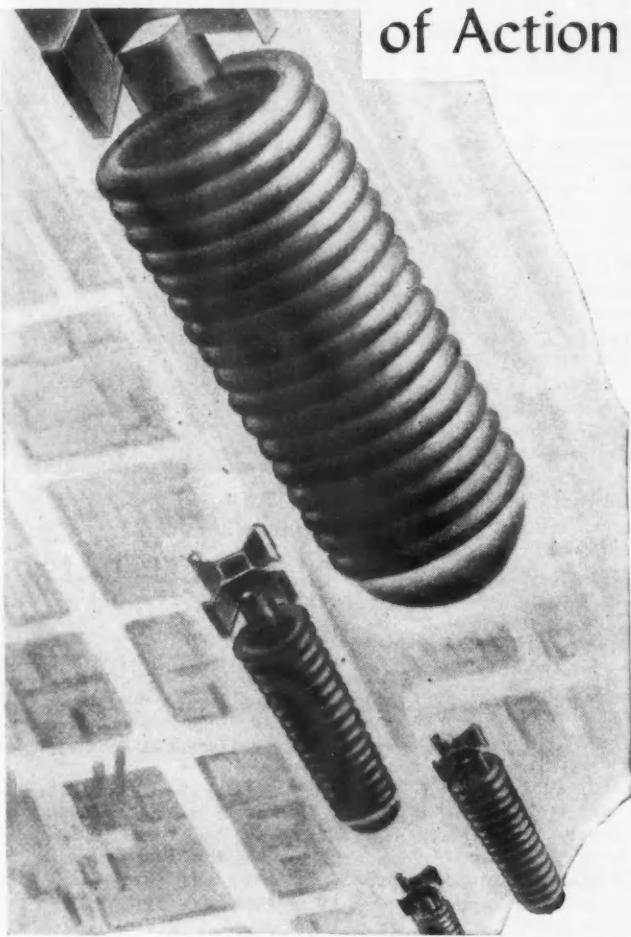
The best "soft" hammers and mallets are rawhide—tough, resilient, long-lasting C/R mechanical rawhide.

They strike effective blows without battering or marring . . . without fatiguing re-coil. They hold their true striking surfaces. Sizes and weights for every need. Hammers are malleable iron with replaceable C/R Rawhide insert faces.

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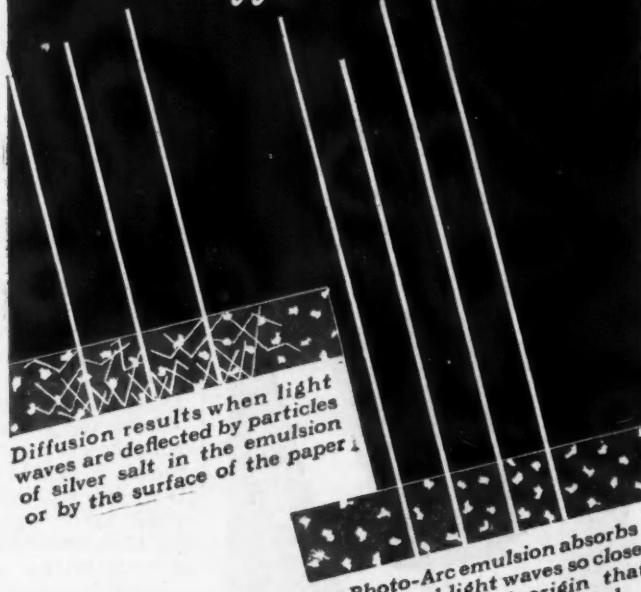
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The Watch Dog . . .
stops annoying blink and flicker of dying fluorescent lamps. Blinking cannot possibly recur.

eliminates needless and futile starting attempts under dead lamp conditions.

safeguards ballasts from operating at short circuit when lamps reach end of their useful life.

outlasts an average of ten 40-watt lamps under specified test conditions. Watch Dog has a rated life of 25,000 hours.

Write for our free bulletin, "How to Use Fluorescent Accessories for Best Lighting Results." Send your request to Section G1243-103, Appliance and Merchandise Dept., General Electric Co., Bridgeport, Conn.

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Hear the General Electric radio programs: "The G-E All Girl Orchestra" Sunday 10 P.M. EWT, NBC. "The World Today" news every weekday 6:45 P.M. EWT, CBS.

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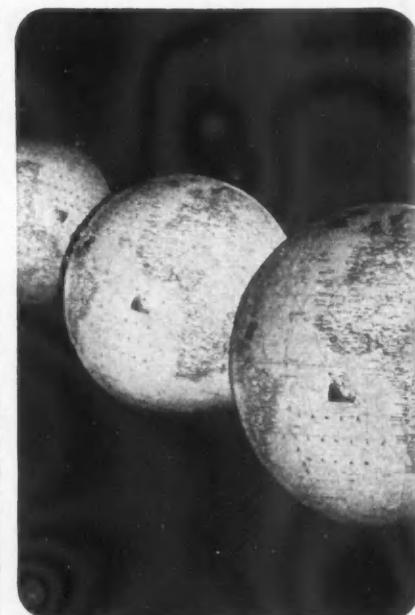
(Continued from page 48)

resent, therefore, all the more Washington propaganda charging those who think of reconversion with a lack of patriotism. It is pointed out that numerous metallurgical projects are based on becoming effective when reconversion comes, and those who frame these plans would like to know how they can approach the problems presented without taking reconversion into consideration.

Dissatisfaction with the prices paid to South American producers for non-ferrous metals threatens to affect a steadily widening range of products. From Chile comes news of the shutdown of two French-owned copper mines because the proprietors failed to make a profit on their sales. The Foreign Economic Administration, in announcing suspension of contracts with these concerns, said that they were "small, high cost smelters," adding that the contracts would not be renewed when they expire January 31. The FEA also said that the two contracts did not involve more than 3 per cent of Chile's output of copper. The contracts were with the United States Commercial Company, formerly the Metals Reserve Agency. Chile's principal copper producing companies, the Braden and the Chile Copper companies, are American-owned. In 1941 we got 130,000 tons of copper from Chile, by far the largest tonnage obtained from any foreign country. The copper situation is slowly becoming more comfortable for consumers. Rationalizing of the uses of secondary copper has been of the greatest help in this. Chile's metallurgical industry maintains close contact with that of Bolivia, emissaries of which republic are now endeavoring to get a better price for tin shipped to the United States.

COMPOSITE AIRCRAFT MANUFACTURE AND INSPECTION, by Leno C. Michelon, Lieutenant (j.g.) A-V(S) USNR, constitutes a practical encyclopedia of composite aircraft manufacturing and inspection. It is an indispensable handbook and reference manual for everybody concerned with either of these aspects of manufacture as well as for trainees in the inspection field. The book provides a complete coverage of the basic materials used in manufacturing composite aircraft — the metals, the woods, the plastics, and the fabrics. It gives in exact detail the Army and Navy Aeronautical Specifications for each of these materials. It presents the inspection instruments and methods used to insure adequate performance and maximum safety.

This 546-page book may be obtained from the publishers, Harper & Brothers, 49 East 33 St., New York, N. Y., at \$6.00 per copy.



New Worlds TO CONQUER IN 1945

Look out for suddenly issued orders that may quickly end much war goods manufacturing. Look for swift changes to many urgently demand peace-time products. Whenever, or whatever these changes may be, water in abundance will still be an absolute necessity.

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Be prepared for the changes of 1945! Get the facts about Layne Pumps and Well Water Systems now. For new literature, or the counsel of an experienced Layne engineer, address Layne & Bowler, Inc., General Offices, Memphis, Tennessee.

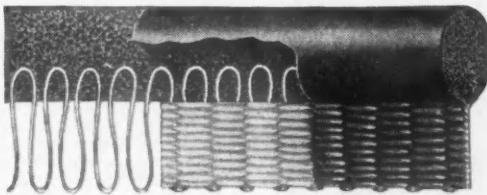
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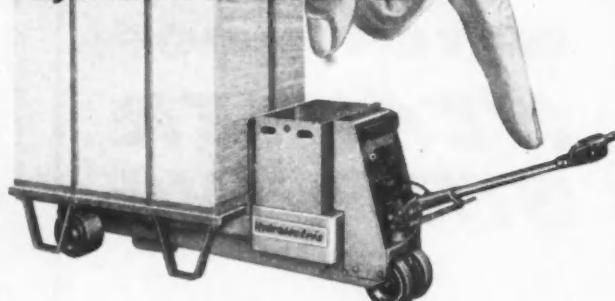
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TONS MOVE with FINGER TIP CONTROL

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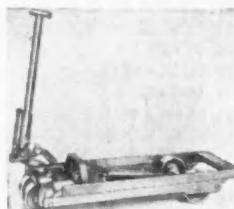
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A multi-stroke Lift Truck combining great lifting capacity with unusual ease of operation and positive safety. Capacity 3500# to 8000#. Pays for itself in time and manpower saved.



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A single-stroke Lift Truck with quick automatic action. Easy lift, roll and steer. Automatic safety release. Built like a fine machine tool. Unequalled by any truck of its type.

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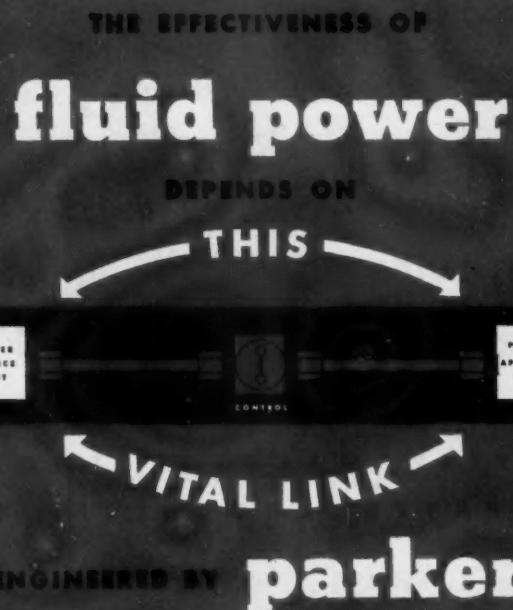
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The Circuit carries fluid power around corners and into tight places—wherever you want it to go. It must be leakproof, vibration-proof, able to stand high pressures and resist corrosion.

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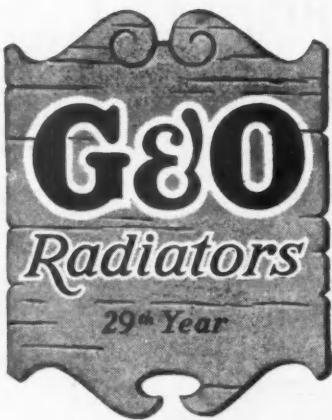
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Our long experience in the tubular scaffolding business is at your disposal. We will quote on platform and dolly equipment according to your special and individual requirements. Address: NATIONAL DEPARTMENT . . . DRAVO CORPORATION, PITTSBURGH (22), PA. (National distributors for American Tubular Elevator Company.)



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QUICKET—For fast (4-second) clamping. Instant ratchet set and release—fulerum screw tightening—one-hand operation—non-creeping grip, even on irregular surfaces.

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ALLOY STEEL—Medium and heavy service 'C' Clamps of even greater than forged clamp capacity.

GROUND CLAMP—Completely copper plated with connection for ground wire.

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Prompt Shipment—Write for Catalog

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THE SURPLUS INVENTORY OF

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AT KRAUSE & LUDWICK GARAGE
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INVENTORY VALUE OVER
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This inventory is surplus resulting from the manufacture of Jacobs L-4 and L-6 Airplane Engines.

All of it is new and in original boxes or cartons ready for immediate shipment and use. The material is classified as

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By order of The Jacobs Aircraft Engine Co.

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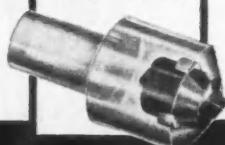
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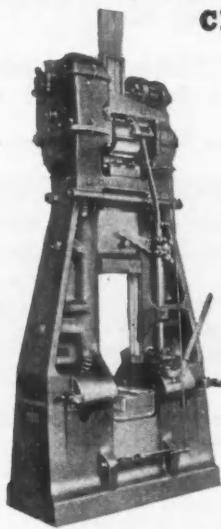
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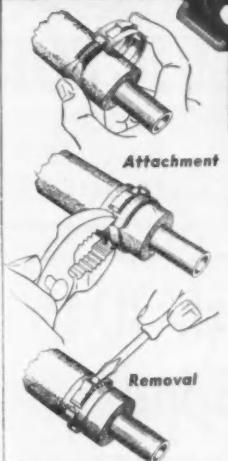
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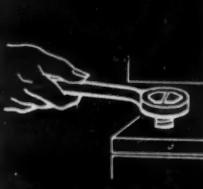
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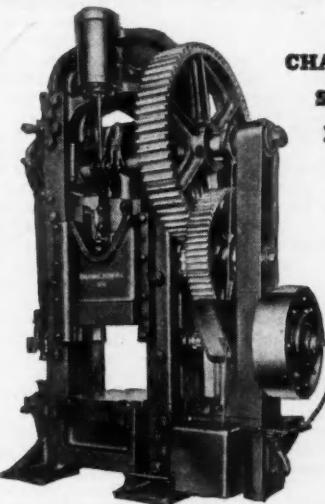
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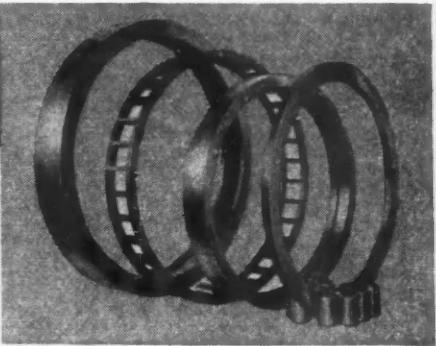
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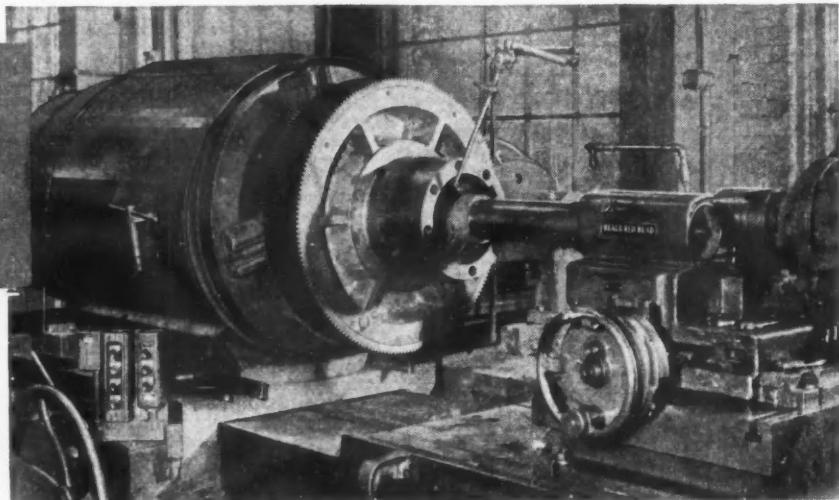
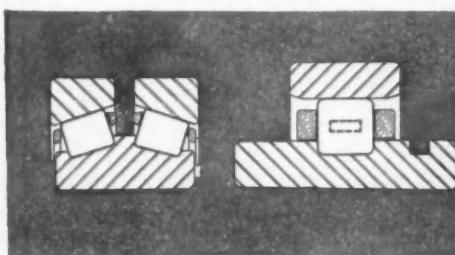
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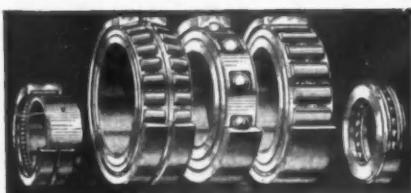
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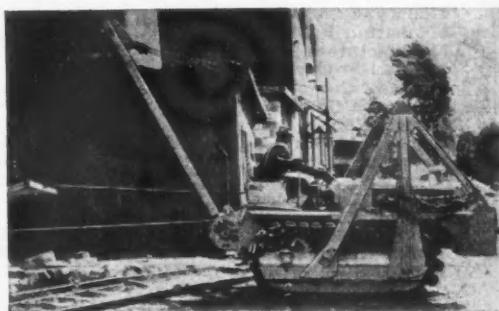
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